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THE STANDARD CYCLOPEDIA OF
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LXI. Landscape in southern California.—Bougainvillea above; Banksian rose in yellow; *Phoenix canariensis*.

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THE STANDARD CYCLOPEDIA OF HORTICULTURE

A DISCUSSION, FOR THE AMATEUR, AND THE PROFESSIONAL AND COMMERCIAL GROWER, OF THE KINDS, CHARACTERISTICS AND METHODS OF CULTIVATION OF THE SPECIES OF PLANTS GROWN IN THE REGIONS OF THE UNITED STATES AND CANADA FOR ORNAMENT, FOR FANCY, FOR FRUIT AND FOR VEGETABLES; WITH KEYS TO THE NATURAL FAMILIES AND GENERA, DESCRIPTIONS OF THE HORTICULTURAL CAPABILITIES OF THE STATES AND PROVINCES AND DEPENDENT ISLANDS, AND SKETCHES OF EMINENT HORTICULTURISTS

BY
L. H. BAILEY

*Illustrated with Colored Plates, Four Thousand Engravings in the Text,
and Ninety-six Full-page Cuts*

IN SIX VOLUMES
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FULL-PAGE PLATES

Facing page

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L

LABELS. There are two reasons for using labels,—to display the names of plants in public plantations for the information of visitors, and to enable the gardener to preserve the name of the plant for his own use. In the former use, the label should be prominent, as permanent as possible, and attractive or at least not obnoxious in itself. In the latter case, the label may be only a tag or tally, and it is often of temporary use.

The characters demanded in a good plant-label in general are legibility, convenience, durability and a reasonable cheapness. The purposes for which labels are needed by the horticulturist may be grouped as follows: (1) For pots, boxes, frames and benches; (2) for stock in storage or transit; (3) for rows, plots or beds in garden, nursery, orchard; (4) for individual trees, shrubs and plants.

Of the materials that may be used for gardeners' labels, wood holds the first place, and the soft, easily worked nature of white pine makes this the favorite species, although other more durable woods, such as cedar, spruce, cypress and mulberry, are used to some extent. Machine-made ready painted wooden labels of convenient shapes and sizes, from 4 to 12 inches in length (see No. 1, Fig. 2049), are carried in all stocks of gardeners' supplies, and are in common use in all work with plants in pots, boxes and benches, and to some extent in out-of-door gardening, but these should not be trusted where the label is expected to endure for a considerable time. In the storage of grafts and cuttings in pits or cellars, two of these labels should be written and slipped together under the tie, the outer one for immediate reference and the under and protected one for security when the other becomes defaced.

Notched or perforated labels (Nos. 2, 3, Fig. 2049), with or without wires, are also prepared for nursery-men's use, those strung with soft copper wire being the best. These are used in the shipping of nearly all trees and shrubs, and here great annoyance would be saved if all names were written distinctly and with a heavy impression. If such labels are used on stock after planting, the grower should use great care that stems and branches are not choked by the wire. The printing of any desired names may be procured on order, effecting a great saving of time and a gain in distinctness.

For marking rows, plots, and beds, stakes should be used large enough readily to attract attention and not be broken over or moved in cultivation. A very serviceable stake for nurseries, trial grounds and gardens is made by cutting 2-inch pine or cypress plank $2\frac{1}{2}$ inches wide and 2 feet long, pointing and giving two good coats of paint. Inscriptions may be stenciled on these as suggested in No. 4, Fig. 2049, written with a heavy pencil, or better, where names, dates and list or plot numbers are wanted, written on a square of sheet zinc and fastened to the face of the stake with small nails. (No. 5, Fig. 2049). An annual coat of paint obliterates old lettering and preserves the wood.

A common wooden label for borders, groups or specimen plants is shown by No. 6 and a variation by No. 7 (Fig. 2049). The stakes should be of some durable wood, and the whole well painted. A paint of pure lampblack and oil is the most indestructible and letters will stand out like type after the lead paint and the very wood surface have weathered away. An effective contrast is obtained by painting the face of the label black and placing the lettering in white.

For display labels on trees and posts in parks and experiment stations, sheet aluminum is now used, with the name stamped in raised letters by a machine or by hand dies (Fig. 2048). Such labels are durable, are not injured by sprays, keep clean, and are cheap in first cost if the number to be made is enough to warrant the purchase of an equipment. We must now provide for labels that withstand spraying compounds.

Of the sheet metals, zinc has heretofore proved



2048. A stamped aluminum label, with raised letters.

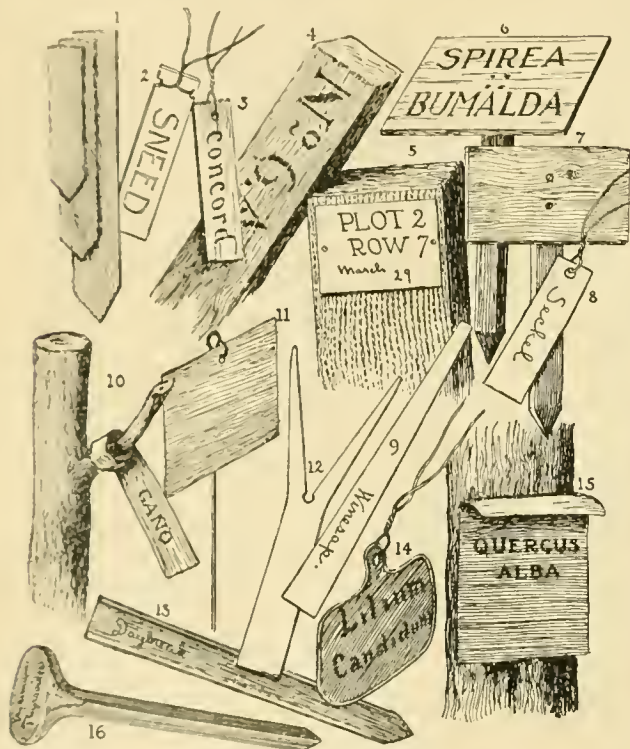
superior to other materials. It may be stamped with steel letter dies or written upon with a common lead pencil, but more commonly a chemical ink is used. The common formula for this in horticultural books is substantially that prepared by the French chemist, Brainnot, in 1837, and is as follows: Two parts by weight of verdigris (acetate of copper), two of sal ammoniac (ammonium chloride), one part of lampblack and thirty parts of soft water. The chemicals should be incorporated with a little of the water, and the remainder added. Keep in a glass bottle tightly corked and shake frequently while using, as the lampblack tends to separate. The zinc, cut in the desired forms, should be prepared by scouring slightly with emery dust or fine sandpaper. The ink may be applied with a quill or coarse steel pen, but a fresh one will be needed with each batch of labels. Inks of an aqueous solution of chloride of copper or of chloride of mercury are also recommended for writing on zinc, which should first be cleaned with a weak solution of muriatic acid. Bichloride of platinum is one of the blackest inks for zinc. A slightly oxidized zinc surface may be written upon with a soft lead pencil, and while the inscription will not be very distinct at first will grow more so with age, and will endure for years.

It is always best to secure a sheet-metal label to the hole or post by both ends if possible; but in many cases a hanging label must be used. A wired zinc label, as shown in No. 8, Fig. 2049, if exposed to the wind will sometimes cut the eye completely out, unless care is taken to twist the wire up tightly. If the end of the label is folded over and the hole punched just beyond the fold, it will not be so likely to pull out. Strips of zinc $\frac{3}{4}$ inch wide and 7 inches long (No. 9, Fig. 2049), coiled loosely around a branch, as in No. 10, are a serviceable form of tree-label, but even these should be noticed every year, that they do not become fastened into the fork of a rapidly-growing tree.

For borders or beds of herbaceous perennials, bulbs,

and the like, the label shown in No. 11 is excellent and inexpensive. A piece of galvanized wire Nos. 6-8 in size, is cut $1\frac{1}{2}$ to 2 feet long, bent to shape and the written zinc tablet closed in. For a more conspicuous label, the zinc may be given a coat of white lead, then one of black enamel paint, and the letters be traced in white. In some European botanical gardens a zinc tablet stamped with sunken letters brought into relief by paint are used for similar purposes. A zinc label, with two wire legs to prevent it from turning around, is shown in Fig. 2050.

There are many designs of cast or enameled metal or porcelain labels, that have found little use in this country. A label of stamped zinc of English manufacture (shown in No. 16, Fig. 2049) is one of the best garden labels. For labeling specimen tree trunks, a sheet of zinc or copper with a little water-ledge bent at the top, painted, enameled black and lettered in white, is neat



2049. Various types of labels.

and useful. It should be secured with copper tacks, and given occasional attention. (See No. 15.) A series of thin sheet-copper labels, to be written on with a stylus against a soft, yielding surface, as a piece of leather, are shown in Nos. 12, 13, 14. These may be too frail for out-of-door use, but are very good for conservatory plants, although the inscription needs rather close examination. Of copper labels, the temper should be taken out and the metal folded on edges. A neat label for conservatory use is made of white sheet-celluloid with a mat surface, as pencil marks show very plainly on it.

Several kinds of tree-labels are shown in Fig. 2052, as follows: Nos. 1, 2, German labels, made of glazed earthenware, with the name colored blue and sunken. Strong copper wire, coiled, to allow of the growth of the limb, holds the label to the tree. No. 3, Cornell label is made of wood. No. 4, double wooden label, consisting of two common wooden labels fastened together. The name is written upon the outside of the

double label, as in any other label, but it is also written on the inside to insure permanence. When the outside writing is worn off the label is opened and the inside is still bright. The label is fastened to the tree by a tack or small nail, as shown in the cut at the right. The label is seen opened in the cut at the left, Nos. 5, 6, zinc labels, used at the New York State Experiment Station, Geneva. The wire is driven into the tree, and the name is written or printed on the zinc with black paint. No. 7, common handmade wooden tag, taken from an old tree in the test orchard of the late Charles Downing, Newburgh, New York. No. 8, thin copper label, with the name indented into the metal by the use of a hard-pointed instrument.

Some metal labels are apt to tear out at the hole when exposed to winds. No. 9, common painted pine label used by nurserymen, and costing (without the copper wire) about 35 cents a thousand for the common size, which is $3\frac{1}{2}$ inches long. No. 10, Lode-man's label, used somewhat at Cornell, consisting of a tag of sheet lead securely fastened to a coiled brass wire. The wire is secured to the body of the tree by a staple or screw-eye, and it is expected that the wire will become imbedded in the trunk as the tree grows. No. 11, common zinc label or talley. A good vineyard label is shown in Fig. 2051, described by Bailey as follows: The figure is Paddock's vineyard label (designed by W. Paddock, State Experiment Station, Geneva, New York). The label is a strip of heavy zinc secured to a stiff galvanized wire. This wire or shank is provided with a hook at the lower end and a half-hitch near its middle, so that it can be securely adjusted to the wires of the trellis, holding the label well above the foliage.

S. C. MASON.
L. H. B.†

LABLAB: *Dolichos*.

LABURNUM (ancient Latin name). *Leguminosæ*. Including *Podocytisus*. **GOLDEN-CHAIN**. Ornamental trees or shrubs chiefly grown for their showy racemes of yellow flowers.

Deciduous: lvs. alternate, petioled, 3-foliate, without stipules; fls. slender-pedicelled, in terminal simple racemes, mostly pendulous; calyx 2-lipped, with obtuse, short lips; corolla papilionaceous, with the petals all distinct; stamens 10, all connate; ovary stalked; fr. a linear pod with several seeds, compressed, tardily dehiscent; seed without appendage at base.—Three species in S. Eu. and W. Asia, often included under *Cytisus*. All parts of the plants are poisonous, especially the young frs. The hard, tough and close-grained wood is susceptible of a very fine polish, and is manufactured into various small articles.

The golden-chains are handsome small trees with dark



2050. A metal garden label.



2051. Paddock's vineyard label.

green trifoliate leaves falling late in autumn without change of color, and with drooping racemes of bright yellow flowers in late spring, followed by long narrow pods remaining on the tree a long time. They are adapted for planting on rocky slopes or in borders of shrubberies, where they should be allowed enough space to show to the best advantage their graceful, drooping racemes of golden flowers, which contrast with the dark green foliage. They are hardly ever attacked by insects or fungi.—*Laburnum alpinum* is the hardiest species and perfectly hardy as far north as Massachusetts; *L. anagyroides* is somewhat less hardy, while *L. caramanicum* is tender. They thrive in any kind of well-drained soil, including limestone, and grow as well in partly shaded positions as in sunny ones. Propagated by seeds, sown usually in spring, and also by layers; the varieties are mostly grafted or budded on seedlings of one of the species.

anagyroides, Medikus (*L. vulgare*, Griseb. *Cytisus Laburnum*, Linn.). GOLDEN-CHAIN. BEAN-TREE. Fig. 2053. Large shrub or small tree, to 20 ft., with erect or spreading branches: branchlets appressed-pubescent, grayish green: lvs. long-petioled: lfts. elliptic or elliptic-ovate, usually obtuse and mucronulate, glaucous-green and appressed-silky pubescent beneath when young, 1-1½ in. long: racemes silky-pubescent, 4-8 in. long; fls. about ¾ in. long: pod appressed-pubescent, with thick keel, about 2 in. long; seeds black. May, June. S. Eu. Gn. 25, p. 518; 34, p. 30, and 51, p. 302. G.C. III. 36:318. H. W. 3, p. 101.—There are many garden forms. Var. *aureum*, Rehd. (var. *chrysophyllum*, Schneid.), with yellow foliage. F.S. 21:2242, 2243. F. M. 1875:182. G.Z. 20:129.

Var. *bullatum*, Schneid. (var. *involutum*, Hort.), with curled lfts. Var. *Carlieri*, Schneid. (*L. vulgare Carlieri*, Kirchn.). Lvs. smaller: fls. smaller in short upright racemes, often several from one bud. Var. *pendulum*, Rehd., with pendulous branches. Gn. 25, p. 522. G.M. 45:317. Var. *quercifolium*, Schneid., with sinuately lobed lfts. Gn. 25, p. 520; 34, p. 30. Var. *sessilifolium*, Schneid., with crowded, sessile lvs. Var. *Alschingeri*, Schneid. (*L. Alschingeri*, Koch). Racemes shorter, lower lip of calyx longer than upper lip: lvs. more silky. S. E. Eu. Var. *autumnale*, Rehd. (*L. vulgare autumnale*, Kirchn. *L. vulgare bifera*, Lavalé. *L. vulgare semper-florens*, Nichols.). Blooms a second time in late summer.

alpinum, Griseb. (*Cytisus alpinus*, Mill.). SCOTCH LABURNUM. Shrub or tree, to 30 ft., similar to the former: branchlets glabrous or hirsute when young: lfts. usually elliptic, acute, light green and glabrous beneath or sparingly hirsute, ciliate, 1-1½ in. long: racemes long and slender, glabrous or sparingly hirsute; fls. smaller: pod thin, with the upper suture winged, glabrous; seed brown. June. Mountains, S. Eu. B.M. 176 (as *Cytisus Laburnum*). Gn. 25, p. 519; 34, p. 30. R.H. 1912, p. 446. G.M. 45:316. G. 36:477. Var. *pendulum*, Koch. With pendulous branches. Gn. 25, p. 522. A var. *aureum* is advertised.—This species flowers

about 2 weeks later than the former, and has much longer and more slender racemes; it also is of more upright and stiffer growth and hardier.

Wätereri, Dipp. (*L. Pärksii*, Hort. *C. alpinus* × *C. vulgaris*, Wittst.). Hybrid of garden origin, but found also wild. Lvs. beneath and racemes sparingly pubescent: racemes long and slender: pod with narrow wing, sparingly appressed-pubescent, few-seeded. G. 24:355. G. M. 45:313.—As hardy as *L. alpinum* and sometimes considered to be a variety of that species.

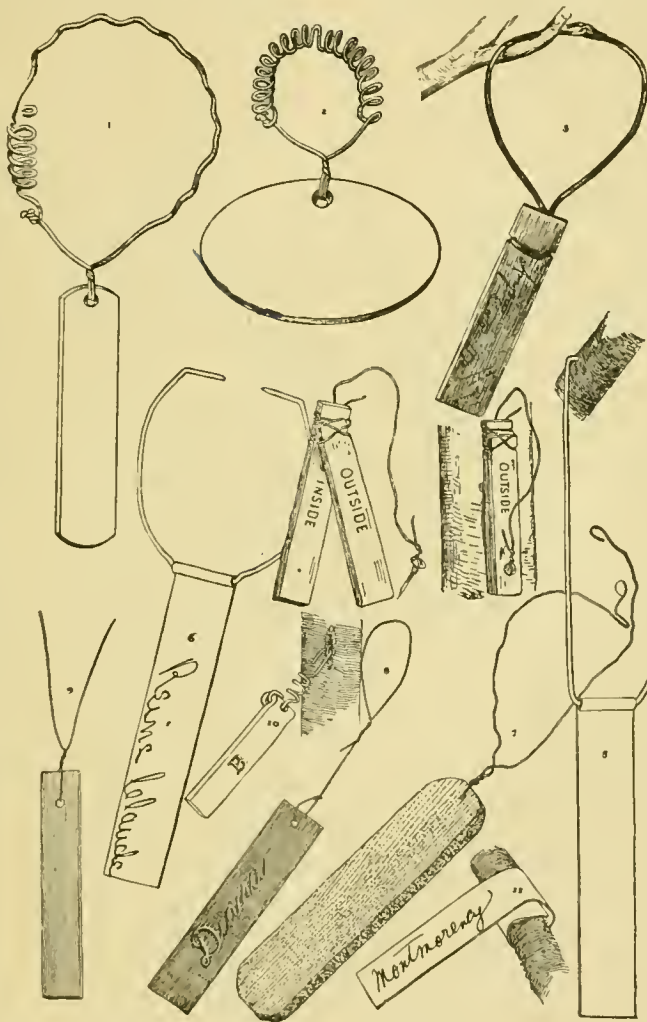
Adamii, Kirchn. (*C. Adamii*, Poir. *C. Laburnum purpurascens*, Loud. *Laburnocytisus Adamii*, Schneid. *L. vulgare* × *Cytisus purpureus*). Originated at Vitry, near Paris, about 1826. Habit and foliage usually almost like *L. anagyroides*, but fls. dull purplish, rarely yellow; sometimes bearing a few branches with the fls. and lvs. of *Cytisus purpureus*. A very interesting form, but of less ornamental value. B.R. 1965. B.H. 21:16-18. G.C. III. 36:219; 50:162.—One of the so-called graft-hybrids which have recently been termed chimæras,

as there is no fusion of cell-contents and nuclei, but only a mixture of tissues.

L. caramanicum, Benth. & Hook. (*Podocytisus caramanicus*, Boiss.). Erect shrub, to 4 ft., much resembling in foliage and habit the *Cytisus sessilifolius*, with long and slender terminal upright racemes. July-Sept. Asia Minor. R.H. 1861, p. 410. G.C. III. 48:454. B.M. 7898.—*L. frégane*, Griseb., *L. ramentaceum*, Koch, and *L. Waldenii*, Lavalé.—*Petteria ramentacea*.

ALFRED REHDER.

LABYRINTHS or mazes are intricate and confusing networks of walks and passages within hedges of evergreen, formerly employed as a garden entertainment and conceit. They are still kept up in some Old World gardens as relics of the past. They were popular in the



2052. Tree labels of many patterns.

sixteenth and seventeenth centuries. Fig. 2051 is the plan of an English labyrinth of two centuries ago. It would be vandalism to destroy so fine an example of a style of gardening no longer fashionable, but folly to copy it in a modern garden. Mazes are made of clipped evergreens of various kinds.



2053. *Laburnum anagyroides*. ($\times \frac{1}{2}$)

LACÆNA (one of the names of Helen, which Lindley states may be applied to this plant on account of its beauty; but he adds it may also be derived from *Lakis*, a cleft, alluding to the divisions of the lip). *Orchidaceæ*. A little-known group of epiphytic orchids inhabiting Central America and Mexico.

Pseudobulbs rather long, ovoid, smooth at first; lvs. large, elliptic-pointed and contracted into a petiole, plicate venose; raceme pendent from the base of the pseudobulbs, loose, bearing up to 10 medium-sized fls.; sepals and petals nearly equal, elliptical, half-spreading; labellum equalling the petals, articulated to the base of the column, clawed, with the lateral lobes incurved, terminal larger, spreading and narrowed at the base to a broad claw; column rather long, winged, hooded at the top; pollinia 2 on a simple stipe.—Only 2 species.

The plants should be grown in baskets or on blocks of wood like stanhopeas; if potted the racemes are likely to bury themselves in the soil. At the end of October, water should be almost entirely withheld for a few weeks. The flower-stalks appear in spring.

bicolor, Lindl. (*Luiddemánia Sanderiána*, Kränzl.). Racemes drooping, about 18 in. long, bearing 9 or 10 fls.; fls. greenish yellow, covered externally with short hairs; petals with 3 purple streaks; labellum hairy, spotted with purple. Discovered about 1843 in Guatemala, at an elevation of 7,000 ft. B.L. 30:50. Var. *glabrata*, Lem. Fls. everywhere nearly glabrous, creamy white. Not in the American trade. L.H. 1:33.

Var. *álba*, Hort. Fls. yellowish white, without purple markings.

spectabilis, Reichb. f. Fls. about 1 in. diam., whitish, suffused with pink and speckled with purple; sepals concave orbicular; petals smaller, connivent. Costa Rica. Mex. (?). B.M. 6516.—Far more handsome than the former, but not advertised in Amer.

HEINRICH HASSELBRING.

LACE-BARK: *Lagetta*; also *Gaya* and *Hoheria*.

LACE-LEAF, LATTICE-LEAF: *Aponogeton*.

LACHENALIA (Werner de Lachenal, 1736–1800, professor of botany at Basel). Including *Scillópsis*. *Liliaceæ*. **CAPE COWSLIP.** Small Cape bulbs that are easily flowered in a cool greenhouse in early spring or even in winter; some of them are useful also for the window-garden.

Plant comprised of a tunicated bulb, a leafless peduncle or scape bearing a raceme or spike of fls. in shades of red and yellow, sometimes white, and usually 2 lvs. at the base of the scape; perianth tubular, persistent, the 3 outer segms. oblong and slightly swollen near the apex, the 3 inner segms. commonly longer and obtuse-spatulate; stamens 6, attached in the perianth-tube; style long and slender, with capitate stigma; caps. loculicidally 3-valved, with turgid black seeds.—Species about 50, in S. Afr. They have a remarkable range of color, and with good management may be kept in an attractive condition for 2 months or more. There are species with bell-shaped fls. and some in which the fls. are all more or less erect, but the favorite types are the long, cylindrical, pendulous fls. with the brilliant red and yellow colors. But few species are cult., the most popular being *L. tricolor*, particularly its var. *Nelsonii* and some of the recent forms with personal names. *L. pendula* is perhaps second in popularity, the others being known chiefly to bulb fanciers. Lachenalias are very distinct in coloring and general appearance. They usually have 2 lvs. (sometimes 5 in. cult.), rarely 1, and the bulbs are globose, tunicated, and about $\frac{1}{2}$ –1 in. thick. An exceptionally strong bulb, under the most favorable conditions sends up 3 or 4 erect fl.-stalks 9 in. high, with as many as 40 fls., each 1–1½ in. long. Under careless treatment the lvs. and fl.-stalks are weaker, and bear perhaps 6–12 fls. Lachenalias are good subjects for hanging-baskets.

It is well to make one job of it, planting freesias and lachenalias together. Six are planted in a 6-inch pot, in good rich loam. They probably do as well without leaf-soil, if the drainage is good. They are stored in a well-protected coldframe until late in November, but might be kept longer, as a pinch of frost will not hurt them. After they are brought into the greenhouse, and make good growth, plenty of water may be given, and, occasionally, liquid manure. A night temperature of 50° F. will be found about right, but they scarcely bear forcing until the flowering scapes show. If forced before the bulbs show, the flowers are often malformed. They last in bloom from six to eight weeks, after which follows the same routine.—After blooming, the plants should be set on a shelf in a light position and watered as carefully as before the blooming season, less water being given as signs of maturity appear; viz., discolored leaves and withered flower-stems. When thoroughly ripened, they are stored in the pots they have grown in and kept quite dry until the month of August. They must be repotted then. If by chance drip should strike the soil, the plants may be found starting into growth. The bulbs multiply rapidly, more than doubling in a season. Fully one-third of the extra bulbs will be serviceable, and still more would make bloom of less decorative value. There are many more—bulbets—which can be sown on the borders of carnation or violet benches, a large number making good-sized

bulbs in one season. Seeds of lachenalias germinate readily in a few weeks, and with good treatment many seedlings will bloom before going to rest. In the opinion of the writer, *L. Nelsonii*, is still the most satisfactory kind to grow. (T. D. Hatfield.)

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A. Perianth ventricose, oblique at the base.

1. *reflexa*, Thunb. (*Calanthus complicatus*, Willd.). Bulb globose, $\frac{3}{4}$ in. or less diam.: lvs. 2, thin, falcate, clasping the base of the st. for 1-2 in.: peduncle and infl. 2-6 in. long; spike usually few-fl., the rachis flexuose; fls. all erect or spreading, yellowish, about 1 in. long; inner segms. slightly longer than the outer and spreading at the very tip; stamens included, but style becoming exerted.—*L. Regeliana* is a hybrid of this and *L. tricolor* var. *aurea*.

AA. Perianth oblong to cylindrical, not oblique or ventricose.

B. Fls. (at least the lower ones) drooping or pendulous.

2. *rubida*, Jacq. Bulb globose, about $\frac{1}{2}$ in. thick: peduncle and infl. 6-9 in. long; lvs. usually 2, much-narrowed to base, spotted; raceme 6-20-fl.; outer segms. bright red, tipped green; inner ones yellow below the tip, a little longer than the outer segms.

3. *pendula*, Ait. Bulb globose, about 1 in. thick: peduncle and infl. 6-12 in. long, more robust than in Nos. 2 and 4; raceme few- or many-fl., 2-6 in. long, all except the upper fls. more or less nodding; outer segms. linear-oblong, yellow, passing upward into red, not spotted; inner bright red-purple at the tip, little if at all exceeding the outer. B.M. 590. Gn. 18:60; 23, p. 142; 33, p. 249, and 45, p. 355. Gt. 61, p. 218. G.W. 10, p. 329. G. 5:551. F. 1871:265. V. 8:172. Var. *aureliana*, Hort., has outer segms. red, barely tipped yellow; inner ones tipped green. R.H. 1890:396. G.C. III. 23:195.

4. *tricolor*, Thunb. Bulb globose, to 1 in. diam.: peduncle and infl. to 1 ft.: lvs. usually 2, 6-9 in. long, often spotted; raceme mostly 3-4-fl., sometimes many-fl.; lower fls. nodding; outer segms. yellow, tipped green; inner purplish red at the tip, much exceeding the outer. L.B.C. 8:767. B.M. 82. F. 1871:265. Gn. 18:60; 47, p. 163. G.W. 10:329. Var. *quadricolor*, Baker (*L. quadricolor*, Jacq.). Perianth with a red base and greenish yellow middle; outer segms. tipped green; inner ones tipped red-purple. L.B.C. 8:746. Var. *luteola*, Baker (*L. luteola*, Jacq.). Perianth lemon-yellow, tinged green toward the tip. B.M. 1020; 1704. L.B.C. 8:734. F.S. 18:1873. Var. *luteola maculata*, Hort. (*L. luteola maculata*, Hort.), differs from the

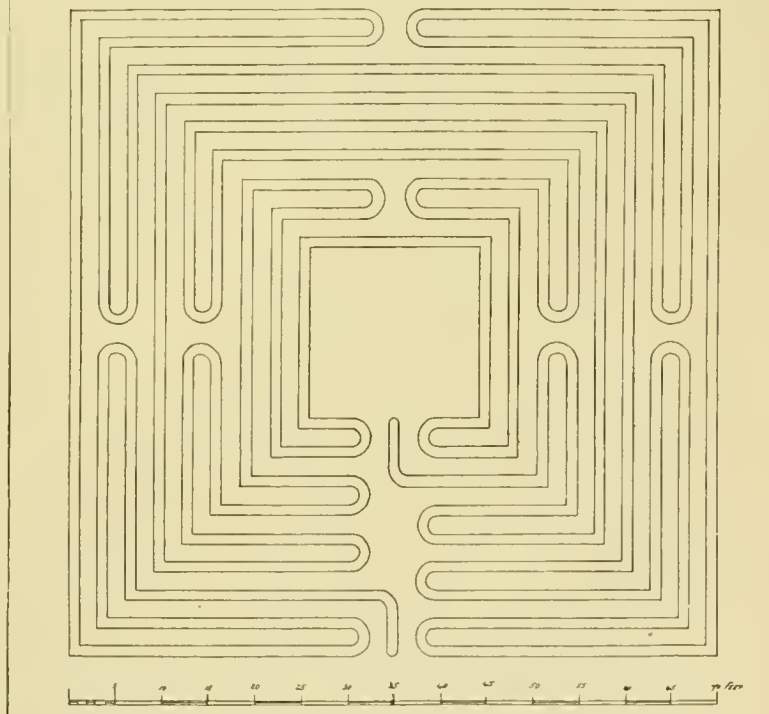
preceding in having spotted foliage. Var. *Nelsonii*, Baker (*L. Nelsonii*, Hort.). Fig. 2055. Perianth bright yellow, both series of segms. faintly tinged green; probably the lachenalia most grown in this country, bearing freely for a long season long racemes of brilliant fls.: treated much as are hyacinths indoors, being kept cool. Gn. 49, p. 470; 75, p. 143. Gng. 5:262. J.H. III. 30:231; 62:291; 63:136. Gn.W. 16:25; 21:301. G.W. 43:591; 52:724. G.Z. 31:121. G. 19:174. Var. *aurea*, Hook. (*L. aurea*, Lindl.). Perianth bright orange-yellow. F. 1871:265. B.M. 5992.—Baker observes that "the varieties are connected by intermediate stages. Several hybrids between *L. pendula* and the varieties of *L. tricolor* are in cult., the finest of which is *L. Cammi*, Hort., which combines the bright yellow fls. of *L. aurea*, with the habit of *L. pendula*." Var. *superba*, Hort., is described as a very large form with boldly colored fls. Var. *d'Ancona*, Hort., is a form with light yellow fls. tipped green and purple.

BB. Fls. not drooping, all erect or at least spreading.

5. *orchioides*, Ait. Bulb globose, to 1 in. diam.: lvs. usually 2, strap-shaped, often spotted, 1 in. wide, clasping the base of the st.: peduncle and infl. 6-12 in.; fls. white, yellow, red or blue, all ascending, the perianth only about $\frac{1}{2}$ in. long; stamens and style included; inner segms. somewhat longer than outer. B.M. 854; 1269. L.B.C. 11:1076 (as *L. mutabilis*). "The most striking color forms," says Baker, "are *atroviolacea*, hyacinth-blue; *virenti-flava*, greenish yellow, and *mutabilis*, inner segms. dull yellow, tipped red-brown."

6. *glauca*, Jacq. Bulb globose, 1 in. diam.: lvs. as in No. 5: fls. long, white, red, yellow or tinged blue, erect-spreading; perianth $\frac{1}{2}$ - $\frac{3}{4}$ in. long; stamens and style reaching tips of inner segms. which are longer than outer. B.M. 3552. B.R. 1350; 1945 (both as *L. pallida*).

Plan of the Labyrinth on Catherine Hill 1710



2054. The maze on St. Catherine's Hill, Winchester, England.
From a plan made in 1710.

7. *liliflora*, Jacq. Bulb globose; lvs. 2, lanceolate and falcate, about 1 in. broad, with pustules on the face; peduncle and infl. about 12 in., bearing 12-20 densely racemose fls. which are white; perianth $\frac{3}{4}$ in. long, all the segms. spreading, the outer longer than the inner; stamens equaling inner segms. G.C. III. 38:259.

AAA. Perianth campanulate or oblong-campanulate, not oblique or ventricose.

B. Infl. dense, spike-like.

8. *pustulata*, Jacq. Bulb $\frac{1}{2}$ in. diam.: lvs. 2, fleshy, pustulate or blistered on the face, lanceolate; peduncle 3-6 in.; fls. white or faintly tinged red, in a dense spike-like raceme 2-3 in. long; perianth $\frac{1}{2}$ in. long; outer



2055. *Lachenalia Nelsonii*. ($\times \frac{1}{2}$)

segms. slightly longer than inner, and stamens somewhat exserted. B.M. 847. Perhaps synonymous with No. 11. Var. *violacea*, Hort., is cult.

BB. Infl. looser, evidently racemose.

9. *unifolia*, Jacq. Bulb globose, small; fl. 1, linear-subulate and erect, brown-banded and clasping at the base; peduncle and infl. 6-12 in. long, carrying a lax 6-20-fl. raceme; fls. white, or more or less tinged with red or blue; perianth about $\frac{1}{2}$ in. long; inner segms. protruding, and the stamens of similar length. B.M. 766.

10. *convallarioides*, Baker. Bulb globose, $\frac{1}{2}$ in. or less long; fl. 1, linear and erect, channelled; peduncle 4-6 in. long, bearing fls. in a short lax raceme; perianth $\frac{1}{2}$ in. long, purplish becoming white; inner and outer segms. about same length; stamens included; fls. with heath-like odor. There is a var. *robusta*, Baker, more robust, with 20-30 fls., and lvs. rarely 2.

11. *pallida*, Ait. (*L. lucida*, Ker. *L. racemosa*, Ker). Bulb globose, $\frac{1}{2}$ in. diam.: lvs. 2, pustulate or blistered, strap-shaped; peduncle 6 in. long, bearing a moderately dense raceme 2-3 in. long; fls. white, the perianth $\frac{1}{2}$ in. long; outer segms. tipped green, shorter than the inner segms.; stamens equaling inner segms. B.M. 1372; 1517.

L. vridis, Thunb. = *Dipendi filamentosum*.—Various species have been more or less cult. under the name *Scillopsis*, but they belong in *Lachenalia*. The generic names *Orehiops* and *Orehiastrum* also belong here.

WILHELM MILLER.

L. H. B.†

LACTŪCA (from the old Latin name *lac*; referring to the milky juice). *Compōsita*. LETTUCE. A well-known group of hardly annual or perennial herbs, mostly native of the northern hemisphere.

Plants 2-4 or more feet high, with alternate, variously shaped lvs. and small-paniced heads of yellow, white or blue fls.; involucre cylindric, its bracts imbricated in several series; receptacle flat, naked; rays cut off even at apex, and 5-toothed.—More than 200 specific names have been given to the genus, probably half of which are synonyms with but only 8 or 9 known in cult., and these are doubtless forms of but 2 or 3 species. Aside from garden lettuce, only 1 species appears to be in the trade, though wild plants of other species are often gathered for medicinal purposes. All of the species possess narcotic and sedative properties, the sedative known as *lactucarium*, or lettuce-opium, being obtained principally from the European species, *L. virasa*. Lettuce has been known and used as a salad from a very remote period. It is said to have been served at the tables of Persian kings 400 B. C. See *Lettuce*.

A. Fls. yellow.

sativa, Linn. LETTUCE. An annual plant, not known in the wild state but generally supposed to have originated from *L. Scariola*, Linn., in Asia. There are many garden forms assuming an endless variety of forms but which may be divided into 4 rather distinct types.

Var. *capitata*, Hort. (*L. capitata*, DC.). COMMON CABBAGE LETTUCE. LVS. entire or sparingly dentate, broad, rounded, yellowish or brownish green, more or less wrinkled and in some garden varieties much curled, spreading, 6-14 in., usually quite compact.

Var. *intybaea*, Hort. (*L. intybaea*, Jacq. *L. quercina*, Linn.). CUT-LEAVED LETTUCE. LVS. 6-10 in. long, deeply and irregularly cut on the edges, loosely spreading.

Var. *romana*, Hort. COS LETTUCE. One to 2 ft. high; lvs. entire or sparingly dentate, much longer than broad, quite erect, forming a cylindrical or conical-shaped plant.

Var. *angustana*, Hort. (*L. angustana*, Hort.). LVS. 1-2 in. wide, 6-12 in. long, entire, slightly spreading in habit.

AA. Fls. blue or purple.

Plumieri, Gren. & Godr. St. about 6 ft., stout; lvs. much cut, broadly oblong, bluish on the under side; fl.-heads terminal, corymbose, the rays purple. S. France. June-Aug.

L. Bourgei (Boiss.), is a thick-stemmed bristly-lyd. perennial often 6 ft. tall; heads small, with pinkish bracts and lilac rays. Medi. region.—*L. canadensis*, Linn. Biennial or annual 4-9 ft. high; lvs. entire or nearly so. Wild plants often gathered for salad.—*L. perénais*, Linn. Root perennial, 2-3 ft. high; lvs. 8-10 in. long, deeply cut; fls. large, light blue. Native of Eu.—*L. Scariola*, Linn. PAICKLY LETTUCE. Annual or biennial, sometimes 6 ft. high, the st. stiff and often panicately branched; lvs. 1-2 in. wide, 4-6 in. long; fls. yellow, inconspicuous. Intro. from Old World, and now a widely distributed weed.

H. C. IRISH.

N. TAYLOR.†

LADY'S EARDROPS: Short-flowered fuchsias. L. Garters: *Phalaris arundinacea* var. *pecta*. L. Mantle: *Alchemilla vulgaris*. L. Slipper: *Cypripedium*. L. Smock or Meadow-Cress: *Cardamine pratensis*. L. Tresses: *Spiranthes*.

LÆLIA (meaning uncertain). *Orchidaceæ*. A useful and attractive group of orchids, mostly with large, showy flowers borne singly or in two- to many-flowered racemes, which arise from the top of one- to two-leaved pseudobulbs. The plants greatly resemble cattleyas and differ only by the presence of eight perfect pollen masses instead of four.

Leaves oblong, coriaceous or fleshy, not plicate; pseudobulbs terminating the annual growth, ovate, clavate, fusiform or st.-like, long or short, consisting of 1 to several thickened internodes, or of slender and quill-like form with merely a small bulbous swelling at base, sheathed with scales and bearing 1 or 2 lvs. at the summit: sepals subequal, free, spreading; petals wider and sometimes longer, spreading; all usually plane; labellum free from the base of the column, more or less distinctly 3-lobed, the lateral lobes short, erect, folding over the column; middle lobe long, expanded, lanceolate-ovate, etc.; column concave in front, and thus narrowly 2-winged on the edges; pollinia 8, 4 in each locule; scape terminal, long or short, bracted.—About 30 species, dispersed in the maritime provinces of Mex. and Guatemala and in S. Brazil. No species is common to the two widely separated regions. A single species, *L. monophylla*, inhabits the mountains of Jamaica. In their native homes the plants are often found clinging to bare rocks and trees, where they are exposed to the full force of the tropical sun, and, in the wet season, to daily drenching rains. Some of the species grow at great altitudes. Thus, *L. autumnalis* var. *furfuracea*, is always found in alpine regions at elevations of 7,500–8,500 ft. For a list of cult. kinds, see R. A. Rolfe, G.C. III. 7:107, 256, 333, 355; 8:241, 652.

Lælia may be conveniently divided into groups, as follows:

GROUP I (species 1–10).—Pseudobulbs rounded, pyriform or ovate. The plants of this section are medium-sized, with the pseudobulbs terminating each year's growth, sessile at intervals on the rhizome, and sheathed at least at first with bract-lvs. The scape, except in *L. grandiflora*, is long and slender, erect, nodding or subhorizontal, and bears at its end 1 or 2 fls. (*L. anceps*), or a raceme of 2–7 fls. (*L. albidia*). *L. grandiflora*, placed here on account of its thickened pseudobulbs, bears greater resemblance to the members of the next group.

GROUP II (species 11–13).—Pseudobulbs short-cylindrical, st.-like, or swollen-jointed, i. e., consisting of several internodes and sheathed with bracts. These plants are of dwarf habit, bearing 1–2 very large fls. on short scapes, so that the top of the fl. scarcely exceeds the lvs., which are oblong, about 6 in. long, and leathery.

GROUP III (species 14–23).—Pseudobulbs long-oblong, fusiform or clavate, tapering below to a sheathed and jointed stalk. This group contains the largest and most showy lælias. The pseudobulbous sts. are tall and tufted, a foot or more in length, forming robust, compact, almost bushy plants. The flowering sts. of *L. superbiens* are said to attain a height of 12 ft. The racemes bear 3–7 large, handsome fls.

GROUP IV (species 24–26).—Pseudobulbs slender, reed-like and tufted, clothed with scales and often somewhat swollen at base. This group includes a few species which are very distinct on account of their bright scarlet or orange-colored fls. and slender, reed-like pseudobulbs. *L. monophylla* is perhaps the smallest of all lælias, being scarcely over 6 in. high, with pseudobulbs about as thick as a crow-quill. One variety of *L. cinnabarina* has purple fls.

Cultivation of lælias. (E. O. Orpet.)

These orchids have ever held an important place in gardens, and were it not for the trifling generic distinction of having double the number of pollen-masses of the cattleya, they would have been known as a part of the last named, the ease with which both have been

hybridized even from the beginning proving the close affinity; and one authority at least is willing to merge the two, were it not for the mixing up it would cause in garden nomenclature. The Brazilian species, *L. purpurata* and *L. crispa*, are strikingly beautiful, easy of culture, and are long-lived in gardens. These were the first to be used by the hybridist, and the multiple crosses made since, with the later addition of *L. tenebrosa*, show evidence of the gorgeous coloring of the labellum due to the lælia parentage.

It has always been the impression that the Brazilian lælias require very much warmth to enable them to grow well. This has been proved to be an error, as stronger growth is made in an intermediate temperature. The plants get an absolute rest in winter, flower better and grow stronger when kept at a temperature of about 50° in winter.

The Mexican kinds that mostly flower in midwinter, such as *L. anceps* and its white forms, will do equally well in a similar house, but are best grown outdoors in summer in the partial shade of overhanging trees, giving a spraying of water overhead at evening of each hot day. This has been found to be the only way to get the white forms to bloom freely, as they need special treatment and thorough ripening to secure good results. Removal indoors should take place before frost; cool nights seem to invigorate them, but while they experience slight frosts in Mexican uplands, it is harmful here. These lælias make an abundance of roots, and the plants should be kept off the ground to avoid the danger of slugs. If these gain access, soak the pots or baskets in water for an hour and the slugs will appear and can be caught.

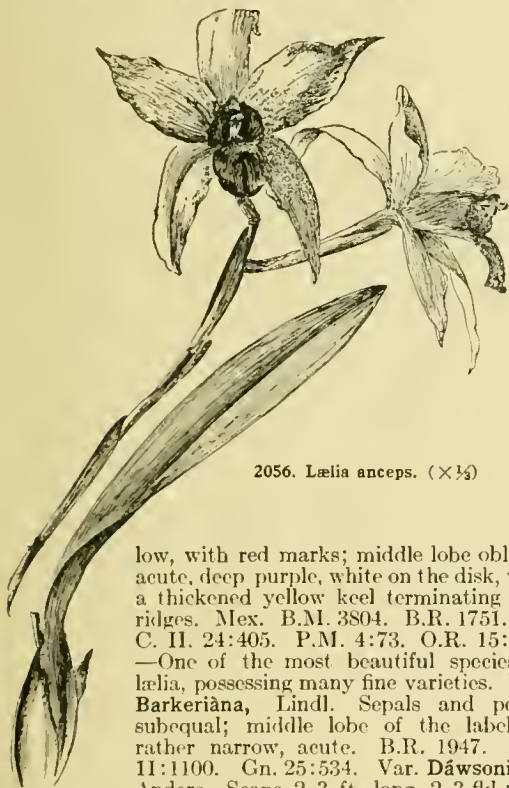
The repotting of lælias must be done in early spring, or just before the appearance of the new bunches of roots at the base of the growths. Native-born species have a regular way of living, but the hybrids have a go-as-you-please habit, due perhaps to their mixed origin, that makes the repotting an operation that lasts throughout the year. Flowers are produced at all seasons, while, with introduced plants, their blooming is as fixed as the days of the year. This makes it hard to make a rule when to repot or separate plants; but, should the roots begin to get outside the receptacle, it is wise to give the plants more space. Good firm osmundine is the best material, as these are strictly epiphytal plants. Imported specimens are received with mats of dwarf polypodium attached, and these often grow with the plants in cultivation, giving a clue to the best way to treat them afterward. The other Mexican species, *L. Gouldiana*, *L. autumnalis* and *L. albidia*, are not so durable in gardens as some others. They are most valuable midwinter-flowering orchids; they need similar culture as that given to *L. anceps*, but have to be replaced by new specimens after a few years, as they are not permanent.

There are many pretty dwarf-growing species, *L. præstans*, *L. Dayana*, *L. pumila*, *L. grandiflora*, *L. Jongheana* and others, that require extra care to keep them in health, and this care is largely in the matter of moisture. The plants are small, need shallow pans and to be suspended close to the roof glass where they dry out speedily, and unless moisture is given regularly, the health of the plants soon weakens. The drying out is desirable, for the plants experience this on rocks or trees in their native habitat, but there they have the benefit of the night dews that amount to a shower of moisture; this is easily imitated by spraying over the plants each dry evening. The roots will take this up during the night, and be fortified for the succeeding day. If one examines the aerial roots of *L. anceps*, they will be found to be in segments, some longer than others, the longer ones being those formed on a dull or wet day when evaporation was slower and the tender-growing tips could grow longer. This is suggestive in a cultural way.

The plant there figured is probably the species in question, although, according to the figure and the accompanying description, the sepals and petals are wider than those of *L. anceps*.

8. *Goudiãna*, Reichb. f. Pseudobulbs ovate, 2-lvd.: lvs. oblong-linear: scape slender, 1-2 ft. long, bearing as many as 6 deep rose-purple fls. resembling those of *L. anceps*; sepals lance-oblong, pointed; petals broader, ovate, acute; middle lobe of the labellum large, deeply colored, throat white and veined; side lobes white. Dec., Jan. Mex. G.C. III. 7:169.—A useful species, large plants often bearing 5-10 racemes. Perhaps only a variety of *L. autumnalis*.

9. *anceps*, Lindl. Fig. 2056. Pseudobulbs scattered on the rhizome, ovate: lvs. 5-9 in. long, oblong-lanceolate: scape from the top of the pseudobulbs, 1½-2 ft. long, clothed with keeled scales and bearing 1-2 very showy, purplish rose-colored fls.; sepals lanceolate-acuminate; petals ovate-acuminate, all with a greenish line on the back; labellum inside of the lateral lobes yellow,



2056. *Lælia anceps*. (×½)

low, with red marks; middle lobe oblong, acute, deep purple, wheel on the disk, with a thickened yellow keel terminating in 3 ridges. Mex. B.M. 3804. B.R. 1751. G. C. II. 24:405. P.M. 4:73. O.R. 15:145.

—One of the most beautiful species of *lælia*, possessing many fine varieties. Var. *Barkeriãna*, Lindl. Sepals and petals subequal; middle lobe of the labellum rather narrow, acute. B.R. 1947. F.S. II:1100. Gn. 25:534. Var. *Dãwsonii*, J. Anders. Scape 2-3 ft. long, 2-3-fl.; fls.

white; interior of the labellum marked with radiating purple lines, with the usual yellow ridge. Juquila, Mex. Gn. 25:534. G.C. III. 1:424. S.H. 2, p. 175. F.M. 1871:530. Var. *ãlba*, Reichb. f. Sepals and petals as in var. *Dãwsonii*; fls. pure white, with the disk of the lip pale yellow. Dec., Jan. G.C. III. 1:485; 15:172. J.H. III. 50:179. Var. *Hilliãna*, Reichb. f. Sepals and petals white; front lobe of the labellum bilobed emarginate. I.H. 33:584. Gn. 25:534. G.C. III. 1:425. Var. *Williamsii*, Hort. Pure white, narrower than in var. *Stella*; labellum white, large, with the disk and throat yellow, marked with crimson-purple. G.C. III. 1:349. Gn. 25:534. Var. *Lageriãna*, Hort. White, suffused with rose; lip dark lavender, mottled and streaked purple, the throat yellow, purple-veined. Var. *Leeãna*, Reichb. f. Fls. white, smaller than in *L. anceps*; petals very narrow and very acute; side lobes of the labellum blunt; middle lobe small, triangular, wavy,

with a thick, well-developed keel; throat yellowish, veined with reddish purple. Var. *Schroederiãna*, Reichb. f. Fls. unusually large; sepals, petals and middle lobe of the labellum pure white; side lobes and throat streaked with broad lines of purplish crimson. Gn. 44:284. G.M. 33:813. G.C. III. 29:94. Var. *Sanderiãna*, Reichb. f. Fls. white; disk of lip crimson. G.C. III. 1:281; 25:136; 13:216. O.R. 9:9; 17:frontis. Gn. 44:284. G.M. 37:88. Var. *Veitchiãna*, Reichb. f. Sepals and petals white; disk of the labellum yellow, veined with brown; lateral lobes and anterior part of the middle lobe veined with purple. Gn. 25:534 (as *L. Veitchii*). Var. *Stella*, Reichb. f. Fls. pure white; labellum with yellow throat, marked with light crimson lines. G.C. III. 1:280 and 8:500. Var. *Amesiãna*, O'Brien. Sepals and petals broad, feather-veined with mauve; labellum white; middle lobe crimson-purple. G.C. III. 23:59. Var. *Ashworthiãna*, O'Brien. Sepals pure white, lance-oblong; petals broadly ovate, also white; front lobe of the labellum broad, expanded, white, with a few blue dots and yellow keels on the throat; side lobes with lines of slaty blue. G.C. III. 15:103. J.H. III. 28:125. Var. *waddoniãnsis*, Hort. Fls. pure white; side lobes of the lip marked with purple lines, disk yellowish. J.H. III. 56:349. G.C. III. 23:125. G.M. 41:115. Var. *Chamberlainiãna*, Hort. Sepals and petals soft rosy lilac; base and side lobes of lip purple-lined, the middle lobe a glaring crimson-purple, the callus orange. G.C. III. 31:71; 49:78. G.M. 45:101. Var. *Percivaliãna*, Reichb. f. Fls. small, but freely produced; sepals and petals white, tinged with bluish pink; lateral lobes of the labellum deep purple at the tips and spotted; throat yellow, with purplish crimson lines; middle lobe creamy yellow at the base; apex purplish. Gn. 25:534. Var. *delicãta*, Hort. ex Williams. Labellum white, suffused with mauve; throat orange-yellow; sepals and petals rose, mauve or lilac. Var. *rõsea*, Reichb. f. A variety having bright rose-colored fls., with the margins of the labellum darker rose. Gn. 25:534. Var. *grandiflõra*, Williams. A robust form resembling the type. G.C. III. 3:105. Var. *holochila*, Rolfe. Sepals and petals nearly alike, pale lilac; lip petaloid, elliptical-lanceolate, light purple, yellow and white at the base. G.F. 4:173. Var. *Scottiãna*, Warner and Williams. Sepals and petals mauve; labellum deep purple, with a yellow throat. Var. *morãda*. This is a name under which importations of large, highly colored forms of *L. anceps* were sold by the Liverpool Hort. Co., England, as var. *grandiflõra*.—Many other varieties appear under Latin names.

10. *rubescens*, Lindl. (*L. acuminãta*, Lindl. *L. pendunculãris*, Lindl.). Pseudobulbs ovate to subrotund, clustered, sometimes rugose, 1-lvd.: lvs. oblong to lance-oblong, emarginate, 4-5 in. long; scape slender, jointed, sheathed with brown scales at the joints, 1 ft. long, with 2-8 graceful, fragrant fls.; sepals spreading, linear-oblong, acute; petals slightly longer and twice as wide, undulate; labellum as long as the petal; middle lobe of the same form but more undulate and with a stain of yellow on the disk, purplish red on the inner surface. B.M. 4905 and 4099. B.R. 26:41; 27:24; 31:69. F.S. 1:9; 7:742. P.M. 10:49. O.R. 14:41; 19:72.—A slender, graceful plant with small, whitish, lilac-tinted or rose-colored fls. much smaller than those of *L. anceps*.

GROUP II.

- A. *Pseudobulbs ovate, evidently thickened.*
- n. *Lip with about 7 undulate keels*..... 11. *Jongheana*
- nn. *Lip without or with plane keels*..... 2. *grandiflõra*
- AA. *Pseudobulbs oblong, more st.-like.*
- B. *Fls. greenish yellow*..... 15. *glauca*
- BB. *Fls. bright colored or white.*
- C. *Labellum firm, fleshy; lateral lobes convolute over the column*..... 12. *pumila*
- cc. *Lateral lobes of the lip resting on the middle lobe*..... 13. *Leeana*

11. *Jongheana*, Reichb. f. Rhizome with remarkably thick root-fibers; pseudobulbs ovate-oblong, 1-lvd.; lvs. broadly oblong, 3-5 in. long, very thick and dark green; scape stout, shorter than the fl., 1-2-lvd.; fls. 4 in. diam., bright amethyst-color; sepals linear-lanceolate, acute; petals broadly oblong-obtuse; labellum convolute; lateral lobes very shallow; middle lobe emarginate, white and crisp, with about 7 golden-yellow undulate ridges in the throat. Brazil. B.M. 6038. R.H. 1873:290. G.C. 1872:425. O.R. 12:273.—A dwarf species with remarkable leathery lvs. Said to equal *L. grandiflora* and *Cattleya Mossii*. Rare in cult. Many varieties are listed under Latin names.

12. *pumila*, Reichb. f. (*Cattleya pumila*, Hook. C. *marginata*, Paxt. *L. præstans*, Lindl. & Reichb. f. *L. Dayana*, Reichb. f. *L. Pinelli*, Hort.). Pseudobulbs small, st.-like, with 1 oblong to linear-oblong lf. 5-6 in. long; peduncle shorter than the lvs., each bearing a single, large, drooping, rose-purple fl.; sepals oblong, acute; petals ovate-oblong, broader, undulate; labellum very involute; lateral lobes subquadrate, middle lobe short, emarginate, waved and crisped; throat yellow, apex rich purple. A pretty dwarf species from Brazil, very variable and useful. B.M. 3656, 5498. B.R. 30:5. F. 1850:89 (as *Cattleya spectabilis*). G.C. II. 23:597; III. 36:354.—Many variations of this plant have been described as distinct species, although botanically but one species. Some of them are well-marked horticultural varieties. Var. *præstans*, Veitch (*L. præstans*, Lindl. & Reichb. f.).



2057. *Lælia purpurata*. ($\times \frac{1}{2}$). No. 22.

A large-flld., highly-colored variety, with the sepals and petals much broader than in the type; labellum rich purple, very rigid and fleshy, lines almost obsolete. B.M. 5498. Gn. 53, p. 550. Var. *marginata*, Hort. (*Cattleya marginata*, Paxt.). Fls. large; sepals and petals rose-crimson; labellum with a white border, crisp. Brazil. P.M. 10:265. I.H. 6:193 (as *Cattleya*

pumila var. *major*). F.S. 18:1900. G.C. III. 22:262. A.G. 11:158. Var. *Dayana*, Dean (*L. Dayana*, Reichb. f.). Sepals and petals rose-purple; labellum with a deep purple margin. Earlier than the type. Brazil. R.H. 1890, p. 490. F.M. 1877:249. Var. *alba*, Hort. Fls. like var. *præstans*, but pure white with the base of the lip yellow. G.C. III. 21:11. J.H. III. 34:27; 43:349; 49:409, 475.

13. *Leeana*, Reichb. f. Hybrid; pseudobulbs cylindrical, somewhat swollen, 1-lvd.; lvs. cuneate-oblong, very coriaceous; sepals and petals spreading, ligulate, acute, somewhat undulate, rose-color; lateral lobes of the labellum semi-ovate, acute, the tips resting on the middle lamella, white, tips purple; middle lobe broad, obcordate. Sept. "Natural hybrid of *L. marginata* and ———?" (Hansen).—As this plant has 4 pollinia, it is probably nearer *Cattleya*. It was imperfectly described by Reichb. as a doubtful hybrid.

GROUP III.

- A. Fls. greenish yellow.
- B. Labellum deeply fringed on the margin.....14. **Digbyana**
- BB. Labellum not fringed.
- C. Evidently 3-lobed.....15. **glauca**
- CC. Obsoletely 3-lobed.....16. **virens**
- AA. Fls. all yellow.....17. **xanthina**
- AAA. Fls. with only the sepals and petals tawny yellow; labellum some other color.....18. **grandis**
- AAAA. Fls. purple, rose or white.
- B. Labellum with several prominent toothed crests.....19. **superbiens**
- BB. Labellum destitute of crests.
- C. Petals and labellum waved and crisped.
- D. Fls. uniformly purple.....20. **Boothiana**
- DD. Fls. white and purple.
- E. Lip ovate-acuminate.....21. **crispa**
- EE. Lip rounded.....22. **purpurata**
- CC. Sepals and labellum plane, or nearly so.....23. **Perrinii**

14. *Digbyana*, Benth. (*Brassavola Digbyana*, Lindl.). Pseudobulbs elongate, st.-like, 1-lvd.; lvs. elliptical, thick, fleshy, plane, slightly keeled; peduncle with a solitary, very large, fragrant fl. 3-5 in. across; sepals and petals similar, oblong, spreading, pale purplish green; petals slightly broader; labellum very large-ovate, entirely surrounding the column, white or cream-colored, with the margin cut into a broad lacinate fringe, which makes the fl. very striking. July, Aug. Honduras. B.M. 4474. B.R. 32:53. F.S. 3:237. G.C. III. 18:153. G.M. 46:307.—A slow-growing orchid.

15. *glauca*, Benth. (*Brassavola glauca*, Lindl.). St. short, creeping; pseudobulbs short, oblong, st.-like, compressed and sheathed with scales, bearing a single oblong, glaucous, very thick and leathery lf.; fls. usually single, on a stalk shorter than the lf., fragrant; sepals and petals spreading, oblong-lanceolate, obtuse, greenish yellow; labellum with a short claw surrounding the column, then expanding into a large 3-lobed limb, yellowish white, streaked with red in the throat. Mex. and Guatemala. B.M. 4033. B.R. 26:44. G.C. III. 7:357.

16. *virens*, Lindl. Plants about 6 in. high; fls. 1 in. across; sepals suberect, ovate; petals lanceolate, subequal; labellum obsoletely 3-lobed, cuneate; apex ovate, crisp, with obscure raised lines toward the base. Brazil.—The fls. are pale yellowish green, of no beauty.

17. *xanthina*, Lindl. Lvs. oblong, longer than the fusiform pseudobulb; raceme 3-5-flld.; fls. 3 in. across, buff-yellow except the lip, which is white in front streaked with crimson-purple; sepals and petals subequal, oblong-obtuse, undulate, leathery and convex; labellum nearly quadrate when spread out, without raised veins. Brazil. B.M. 5144. F.S. 23:2418.—Intro. 1858. A second-rate species.

18. *grândis*, Lindl. & Paxt. Pseudobulbs st.-like, 1-lvd., 1 ft. high: lvs. rigid, oblong-lanceolate: scape erect, bearing 2-5 fls. 4 in. across; sepals and petals lanceolate, the latter a little broader, slightly curled or twisted; labellum white; front lobe large, bell-shaped, crenate-toothed, veined with purple. Spring. Brazil. B.M. 5553. F.S. 7, p. 238, and 23:2473.—A curious species with the sepals and petals colored tawny yellow, contrasting strongly with the whitish purple-veined lip. Var. *tenebrôsa*, God. Lebeuf. Sepals and petals citron-yellow, less undulate; labellum trumpet-shaped, purple, with a broad border of white with many purple veins. G.C. III. 14:221. G.M. 36:531.

19. *supérbiens*, Lindl. Pseudobulbs 1 ft. or more in length, oblong, with 1 or 2 coriaceous oblong lvs. equaling the pseudobulbs in length: scape drooping, 5-6 ft. long, bearing a globose cluster of 10-20 fls. each about 6 in. diam.; sepals and petals nearly equal, spreading, oblong-lanceolate, obtuse, lilac-purple, paler below; labellum as long as the segms., middle lobe broad obovate, waved and crisped; disk with several prominent toothed crests, yellow, deep crimson-purple on the margins; side lobes yellow with purple margins and stripes. Guatemala. B.M. 4090. F.S. 11:1178, 1179. P.M. 11:97. R.H. 1886:324.—A very large plant.

20. *Boothiana*, Reichb. f. (*L. lobata*, Veitch. *Cattleya lobata*, Lindl.). A strong-growing plant: pseudobulbs clavate, furrowed, 1-lvd.: lvs. lanceolate-oblong, about as long as the scape: scape 8-10 in. long, from the axil of the lf., 2-5-fld.; fls. about 5 in. across, uniformly violet-purple with rich crimson veins on the lip; sepals lanceolate, with reflexed margins; petals broad, oblong, undulate, crisp; labellum cucullate, the middle lobe reflexed, all beautifully waved and crisped. Much like *L. crispata* in habit. April, May. S. Brazil. R.H. 1874:331 (as *L. Rivieri*). G.C. 1848:403; III. 10:577. F.S. 20, p. 132. A.G. 13:608. O.R. 12:265.—This plant is not free-flowering, hence it is little cult., although a beautiful and distinct species.

21. *crispata*, Reichb. f. (*Cattleya crispata*, Lindl.). Pseudobulbs clustered, elongate-clavate, 1-lvd.: lvs. large, 1 ft. long, oblong-lanceolate, emarginate: scape with 5-6 large, handsome, fragrant fls.; sepals linear-oblancoate or spatulate, acute, margins revolute; petals much broader, with the margins beautifully waved and crisped; labellum standing forward, recurved at the apex; side lobes rounded, white, yellow at base, streaked with red; middle lobe long, ovate-acuminate, deep purple inside, veined, all remarkably waved and crisped. Summer. On lofty trees fully exposed. Brazil. B.M. 3910. B.R. 1172. Gn. 48, p. 504. J.H. III. 33:197. P.M. 5:5. O.R. 9:201; 17:305.—A fine white-fld. species resembling a cattleya in habit. Var. *Cauwelartiae*, L. Lind. Sepals and petals tinged with greenish yellow; base of labellum yellow. I.H. 38:121.

22. *purpurata*, Lindl. & Paxt. (*Cattleya Brysiæna*, Lem.). Fig. 2057. Pseudobulbs long-elliptical, 6-8 in. high: lvs. solitary, oblong, leathery, dark green, 1 ft. or more in length: scape erect, 3-7-fld.; fls. very large, 6-8 in. across; sepals linear-oblong, spreading, white, suffused with light rose; petals much broader, ovate, undulate, crisp, base attenuate, colored like the sepals; labellum very large, bell-shaped; middle lobe rounded, undulate, crisp, rich purple with darker veins, throat yellow. A robust plant, whose large fls., borne on strong erect stalks, make it one of the grandest liliacs in cult. Spring. Brazil. I.H. 1, p. 54, and 3:83. F.S. 11:1138, 1139. Gn. 54, p. 17; 56, p. 46 (var. *Mrs. Measures*). G.C. II. 14:45; 20:533. A.F. 6:223. O.R. 15:156. G.M. 57:723 (var. *alba*). Var. *atropurpurea*, Williams. Sepals and petals deep rose; labellum large, expanded, purple-magenta; throat yellow, veined with purple. Brazil. Var. *Ashworthiana*, J. Anders. Petals wider than in the type, 2 in. wide, purplish rose, with darker stripes. A highly colored form. G.C. III. 20:39. Var.

Nélisii, Hort., Versch. Sepals and petals subsessile, the former rose-colored outside; midlobe of the labellum ovate, acute. Much like the type in color. I.H. 15:569. Var. *Russelliana*, Williams (*L. Russelliana*, Hort.). Fls. large; sepals somewhat narrow, white, suffused with lilac; petals broader, deeper lilac; labellum large, rose-lilac; throat yellow, marked with rose. Autumn. Var. *Schröderi*, Reichb. f. Sepals and petals white; labellum white, with a tinge of rose in the center; tube pale yellow, with fine, dark purple lines. I.H. 38:139. Var. *Mandariâna*, Hort. Pseudobulbs thinner and narrower than in the type: fls. as large as those of the type, pure white, with a faint tinge of pink on the labellum. Var. *prætexta*, Reichb. f. No description of this plant is available. Many other varieties appear under Latin names.

23. *Pérrinii*, Lindl. (*Cattleya Pérrinii*, Lindl.). Pseudobulbs elongate: lvs. solitary, oblong, coriaceous, 8 in. long, equaling the st.: fls. showy, 2-3 on a short stalk; sepals oblong-linear, obtuse; petals a little broader, all rose-purple, darker at the tips; middle lobe of labellum cucullate, expanded, oblong, obtuse, undulate, with an inflated fistular cavity at the base, destitute of ridges, color deep crimson; lateral lobes erect, acute, pale. Oct.-Dec. Brazil. B.M. 3711 (as *L. intermedia* var. *angustifolia*). B.R. 24:2. P.M. 13:5. G.M. 37:717. A.F. 13:1196; 31:470.—Fls. rather pale. Var. *alba*, O'Brien. Fls. white, labellum tinged with yellow. There are several pale varieties of this plant.

GROUP IV.

- A. Lvs. solitary.
B. Scape 1-fld. 24. *monophylla*
BB. Scape several-fld. 25. *harpophylla*
AA. Lvs. usually 2. 26. *cinnabarina*

24. *monophylla*, N. E. Br. Rhizome a matted mass sending up tufts of lf.- and fl.-sts.: flowering sts. 6-10 in. long, as thick as a crow-quill, rigid and erect, bearing a single linear-oblong, obtuse lf. 2-3 in. long, and several sheathing bracts; fls. 1-2 in. across, vivid orange-scarlet; sepals and petals similar, spreading, oblong, subacute; labellum very small, lateral lobes embracing the column, terminal minute papillose on the disk. Mountains of Jamaica, growing on trees at elevations of 3,000-5,000 ft. B.M. 6683.

25. *harpophylla*, Reichb. f. Hybrid much like *L. cinnabarina*. Pseudobulbs slender, about 10 in. long, each bearing a single lance-linear lf.: raceme short, suberect, bearing 5-10 brilliant scarlet-orange fls.; sepals and petals oblong-lanceolate, acute; middle lobe linear, acuminate, crisp, with a whitish spot. A luxuriant free-flowering species. Feb., March. Brazil. Gn. 24:116. F.M. 1879:372. J.H. III. 43:283.—Probably a hybrid between *L. cinnabarina* and a *Brassavola*(?), Reichb. f.

26. *cinnabarina*, Batem. Fig. 2058. Pseudobulbs elongate, cylindrical, but broadest at the base, sheathed with scales, bearing 1-2 linear-oblong, reflexed, acute, coriaceous lvs.: raceme terminal, erect, 15-20 in. long, with

2058. *Lælia cinnabarina*.

4-5 medium-sized reddish orange fls.; sepals and petals linear-oblong, obtuse, spreading; labellum convolute, reflexed; lateral lobes acute, middle lobe large, oval, crisp. Brazil. B.M. 4302. P.M. 7:193. O.R. 20:361. —A summer-flowering species whose peculiar color and graceful habit render it very ornamental. Var. *crispilabia*, Veitch (*L. crispilabia*, A. Rich. *L. Laurençiana*, Hort.). Fls. amethyst-purple; labellum darker, finely crisp and undulate; raceme 12-14 in. long, bearing 3-5 fls. A pretty, free-flowering variety.

L. bella = *L. grandiflora* × *L. purpurata*. —*L. Candri* = *L. Digbyana* × *L. xanthina*. —*L. canariensis* = *L. harpophylla* × *L. anceps*. —*L. Chocoma*, Rolfe. Habitat of *L. cinnabarina*, but pseudobulbs taller; fls. yellow, in erect spikes. Brazil. —*L. chamonicensis* = *L. purpurata* × *L. Jongheana*. —*L. Chatini* = *L. Jongheana* × *L. harpophylla*. —*L. crispilabris* = *L. crispata* × *L. tenebrosa*. —*L. Danielsii* = *L. Perrini* × *L. Schilleriana*. —*L. Degeestiana* = *L. Jongheana* var. *alba* × *L. flava*. Sepals and petals white, the lip yellow. G.C. III. 48:271. —*L. Digbyana*, Mosses = *Brassocattleya Veitchii*. —*L. edissa* = *L. anceps* × *L. purpurata*. G.M. 13:193. —*L. flavina* = *L. pumila* × *L. flava*. —*L. gultonensis* = *L. anceps* var. *Dawsonii* × *L. cinnabrosa*. —*L. Gilbertii* = *L. tenebrosa* × *L. elegans*. —*L. Görönyi*. Of doubtful origin. Pseudobulbs about 1 in. long, furrowed after first season. —*L. Gröganii* = *L. flava* × *L. crispata*. —*L. Guénia* = *L. Jongheana* × *L. Cowanii*. —*L. Johndna*, Schlecht. Pseudobulbs club-shaped; racemes few fld.; fls. greenish white. Probably Colombia. O. 1912:6. —*L. Latona*, Hort. Veitch. Sepals and petals light orange-yellow; labellum whitish at base, the rest purple bordered with orange-yellow; middle lobe much undulate. A garden hybrid between *L. cinnabarina* and *L. purpurata*. Not advertised in Amer. A. Pericat, Philadelphia, writes as follows of this plant: "Lælia Latona, raised by Veitch, is a beautiful hybrid lalia of a distinct and unusual color, from *L. purpurata* × *L. cinnabarina*, the latter being the seed parent. The sepals and petals are of light orange-yellow; lip whitish at the base, the remainder red-purple bordered with orange-yellow, the margin of the apical spreading; lobe is much undulate." —*L. Lüdlia*, Reichb. f. Plant small, about 6 in. high; fls. produced on young growth; sepals and petals narrow, white, suffused with lilac; lip 3-lobed. Brazil. —*L. lynwoodensis* = *L. Jongheana* × *L. harpophylla*. —*L. Régisii* = *L. Dayana* × *L. Cowanii*. —*L. Sidneyana* = *L. cinnabarina* × *L. Jongheana*. —*L. Stäthæra* = *L. purpurata* × *L. flava*. —*L. tenebrosa* = *L. grandis* var. *tenebrosa* × *L. majalis*.

HEINRICH HASSELBRING.

LÆLIOCATTELEYA (compounded from *Lalia* and *Cattleya*). *Orchidaceæ*. A name proposed by R. A. Rolfe to designate the bigeneric hybrids of *Lælia* and of *Cattleya*, which readily hybridize. The species of the two genera have eight and four pollen masses respectively, while the hybrids are irregular in this respect. Many of the plants are natural hybrids, and many others have been produced by artificial crossing. For a list of læliocattleyas, see Rolfe in G.C. III. 6:78, 155. In the following account *L.* = *Lælia*; *Le.* = *Læliocattleya*; *C.* = *Cattleya*.

The cultivation of læliocattleyas is the same as for *lælia* and *cattleya*. It is therefore important to know the parentage in each case, from which one may know whether warm or coolhouse treatment is needed. Many læliocattleyas are of such a vigorous constitution that they are nearly always in growth.

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KEY TO THE SPECIES.

- A. Fls. light or bright rose 1. *elegans*
 2. *amanda*
 3. *corbeillensis*
 4. *Stelzneriano-Hardyana*
 5. *callistoglôssa*
 AA. Fls. rose-purple, mauve, violet, etc., 6. *Dominiana*
 7. *Andreana*
 8. *Sallieri*
 9. *radinta*
 10. *Duvalliana*
 11. *eximia inversa*
 12. *Martinetii*

- AAA. Fls. white or whitish, or yellow . . . 13. *Schilleriana*
 14. *velutino-elegans*
 15. *intermedio-flava*
 AAAA. Fls. olive-brown 16. *Dormaniana*
 AAAAA. Fls. tinted light blue 17. *exoniensis*

1. *elegans*, Rolfe (*L. elegans*, Reichb. f. *C. elegans*, Morr.). Pseudobulbs terete, st.-like, 15-20 in. high; lvs. solitary, linear-oblong, coriaceous, 10-12 in. long; scape short, stout, 3-7 fld.; fls. 5 in. diam., light or bright rose, fragrant; sepals oblong, acute, often somewhat twisted or with revolute edges; petals much wider, lanceolate, margin somewhat undulate; labellum with the lateral lobes elongate-obtuse, whitish with purple apices, convolute over the column; middle lobe broadened in front, subreniform, margin undulate, crisp, entirely a very deep purple, without raised lines or callosities. May-Sept. Brazil. B.M. 4700. I.H. 4:134 (as *L. Brysiana*); 11:402. G.C. III. 42:248. G.M. 50:627. Gn. 60, p. 196. C.O. 7.—A showy, tall-growing species. Var. *Nyléptha*, O'Brien. Fls. large; sepals tinted with yellow and rose, lightly spotted with purple toward the tips; petals broader, more suffused with purple; lip bright purple in front, paler at the side lobes. G.C. III. 3:176. Var. *Turneri*, Warner. Fls. large, richly colored; sepals and petals bright amethyst-purple, with deeper veins; lip with a large purple blotch on the middle lobe; side lobes white, tipped with rose. Gn. 47, p. 319; 49:384 and p. 385.—One of the finest of the genus. Var. *prasiata*, Reichb. f. Sepals and petals rose, tinged with green; labellum white at the base and side lobes, middle lobe crimson-purple.—Var. *supërba* is advertised.

2. *amanda*, Rolfe (*L. amanda*, Reichb. f.). Natural hybrid between *C. intermedia* and perhaps *L. crispata*. Pseudobulbs thin, fusiform, 5-7 in. long, 1-2-lvd.; lvs. shorter than the pseudobulbs, cuneate-oblong, acute; fls. in pairs, from a small, narrow spathe; sepals oblong-ligulate, acute, light rose, with a grayish hue outside, wavy; petals similar but broader, with darker-tinted nerves on the inside; lateral lobes of the labellum enveloping the column, rich dark purple; middle lobe transversely oblong, short, emarginate, wavy, separated from the others by an exceedingly short isthmus, veined with rich purple. Brazil. I.H. 38:135.

3. *corbeillensis*, Maron. Garden hybrid of *C. Lodigesii* and *L. pumila* var. *marginata*. Pseudobulbs 5-6 in. long, fusiform; lvs. about 6 in. long; fl.-stalk 2-3 in. long, bearing 1-2 showy fls. about 5 in. across; sepals and petals bright rose, the latter veined with deeper purple lines; throat of the labellum veined with yellow on a white ground; blade intense purple, bilobed and undulate. C.O. 5.

4. *Stelzneriano-Hardyana*, Maron. A garden hybrid of *Le. elegans* var. *Stelzneriana* and *C. Hardyana*. Plants vigorous: pseudobulbs 7-8 in. long; lvs. 10 in. long by 2½ in. wide; sepals pale clear rose, deeper on the edges; petals undulate, rose on the margins, fading almost to white at the center; labellum purple-magenta, undulate lacerate on the margin, with a broad purple line in the center of the blade and 2 large white spots in the throat.

5. *callistoglôssa*, Rolfe (*L. callistoglôssa*, Reichb. f. *Le. Arnoldiana*, Hort.). Garden hybrid of *L. purpurata* and *C. labiata* var. *Warsceviczii*. Pseudobulbs as in *L. purpurata*; lvs. 12 in. long; petals broad, oblong, acute; sepals narrower, all pure rose; middle lobe of the labellum broad, retuse, dark purple, with yellow on the disk; side lobes small, obtuse-angled. C.O. 8. Gn.W. 10:501. G. 28:441.

6. *Dominiana*, Rolfe (*L. Dominiana*, Reichb. f.). Garden hybrid. Plants having the general habit of *C. Mossii*: pseudobulbs fusiform, rather short, 1-lvd.; lvs. linear-oblong; raceme bearing few large, hand-

some fls.; sepals narrowly oblong, acute, light purple, with dark reticulations; petals broadly cuneate-oblong, wavy, light purple; labellum cucullate, with the middle lobe large, spreading, all wavy and crisp, deep blackish purple. F.M. 1878:325.—Raised for Veitch by Mr. Dominy from a cross between *C. Dowiana* and some *belia*,—according to Reichenbach, *L. (Lc.) elegans*. R. A. Rolfe suggests the more probable parentage of *C. Dowiana* and *L. lobata*. The first plant flowered in Aug., 1878.

7. *Andreana*, Maron. A garden hybrid between *C. bicolor* and *Lc. elegans*. Pseudobulbs 8–12 in. long, st-like; lvs. oblong, 6 in. long; fls. 6–7 in. across, rose-violet; sepals and petals spreading, narrowly oblong, with the margins recurved, those of the petals undulate; labellum contracted in the middle, with a subquadrate toothed and undulate middle lobe, violet-purple. R.H. 1896:328.

8. *Salliéri*, Maron. Garden hybrid between *L. purpurata* var. *Williamsii* and *C. Loddigesii*. Pseudobulbs 1–2-lvd., about 10 in. high; lvs. 8 in. long, 3 in. wide; fls. several on a stalk, which is shorter than the lvs., 5–6 in. across; sepals and petals mauve, with deeper lines; labellum tubular, colored like the segms., and expanding into a earmine blade, pale at the tip.

9. *radiata*, Maron. Garden hybrid of *L. purpurata* and *C. nobilior*. Pseudobulbs almost round, bearing 1–2 coriaceous lvs. 7 in. long by 2½ in. wide; fl.-stalks about 7–8 in. long, bearing several large, showy, violet-red fls.; labellum deep red, with purple veins and a whitish throat.

10. *Duvaliana*, Hort. Hybrid between *L. purpurata* and *C. Luddemania*. Sepals and petals half-spreading, light mauve; labellum broad, dark maroon-crimson on the lobes and in the throat, which is traversed by darker lines.—According to Arnold & Co., handsome fl. of striking appearance.

11. *eximia inversa*, Hort. Hybrid between *L. purpurata* and *C. Warneri*, the inverse cross of *Lc. eximia*. Sepals and petals deep rose-purple; labellum bright magenta-crimson.—Said by Arnold & Co. to be one of the finest hybrids yet raised between these genera, resembling *C. Warneri*.

12. *Martinéti*, Maron. Garden hybrid between *C. Mossiae* and *L. grandis* var. *tenebrosa*. Fls. resembling those of the *C. labiata* group; sepals and petals rose-violet; labellum red to mauve, pale at the margins, and netted with numerous deep red veins. G.M. 46:511.

13. *Schilleriana*, Rolfe (*L. Schilleriana*, Reichb. f.). Lvs. 8 in. long; fl.-sts. 20 in. long; sepals and petals white, elongate-lanceolate; labellum veined with purple on the throat; disk purplish yellow, middle lobe spotted crimson-purple. A natural hybrid between *C. intermedia* and *Lc. elegans*, Brazil. Var. *alba*, Hort. Petals and sepals pure white; middle lobe of the labellum rich earmine-magenta, presenting an agreeable contrast. June, July. I.H. 31:526. Gn. 17:132.

14. *velutino-élegans*, O'Brien. Garden hybrid of *C. velutina* and *Lc. elegans*. Resembles in habit a stout form of *C. velutina*: fls. fragrant, 3–4 on an upright st.; sepals and petals creamy white, tinged with nankin-yellow and veined with rose; labellum bluish white at base, side lobes folded over the column; middle lobe broad, toothed and crisp on the margin, rich crimson-purple, veined with white and having an orange blotch at the base.

15. *intermedio-flava*, Maron. Garden hybrid of *C. intermedia* and *L. flava*. Of medium habit: sepals and petals clear yellow; labellum with a bright rose-purple blotch in front.

16. *Dormaniana*, Rolfe (*L. Dormaniana*, Reichb. f.). Natural hybrid of *C. bicolor* and *L. pumila*. Pseudobulbs terete, thin, slender, about 1 ft. long, 1–2-lvd.:

lvs. oblong-ligulate, acute; peduncle 2–5-fl.; petals and sepals narrow oblong-ligulate, olive-brown, marbled outside with wine-red spots; labellum light purplish white, with darker veins; middle lobe transversely obovate, mauve-purple. Brazil.

17. *exoniensis*, Rolfe (*C. exoniensis*, Reichb. f.). Garden hybrid probably between *C. labiata* and *L. crispata*. Sepals ligulate-acuminate; petals oblong-cuneate, plicate, all tinted light blue; labellum undulate, crisp, deep orange at base with whitish side lobes; middle lobe rich purple, with darker veins.

Lc. Aclandiae=*L. purpurata* × *C. Aclandiae*.—*Lc. Adolphus superba*=*L. cinnabarina* × *C. Aclandiae*. Fls. waxy; sepals and petals reddish Indian-yellow, ruby-spotted; front of lip and tips of lateral lobes purplish rose. G.C. III. 32:111. G.M. 45:666.—*Lc. Albertii*=*L. purpurata* × *C. velutina*.—*Lc. Alschiana*=*L. purpurata* × *C. Schilleriana*.—*Lc. Andréndri*=*Lc. elegans* × *C. granulosa* var. *Schofieldiana*.—*Lc. amabilis*=*Lc. Fascinator* × *C. Luddemanniana* var. *Stanleyi*.—*Lc. amena*=*L. harpophylla* × *C. Eldorado* var. *alba*.—*Lc. Andromeda*=*L. flava* × *C. aurea*. Sepals and petals yellow; lip purple, marked, with yellow. Gn. 71:323.—*Lc. Ardena*=*Lc. callistoglossa* × *L. Digbyana*.—*Lc. Armstrongae*=*Lc. Geo. Woodhames* × *C. Dowiana* var. *rosata*.—*Lc. aurensis*=*Lc. Behrensiana* × *C. aurea*.—*Lc. Balbi*=*L. cinnabarina* × *C. Schroederæ*.—*Lc. Baskette*=*Lc. eximia* × *C. Schroederæ*.—*Lc. Behrensiana*=*Lc. elegans* × *C. Loddigesii*.—*Lc. bella*=*L. purpurata* × *C. labiata*. Sepals and petals light lilac; lip purple, marked with yellowish white.—*Lc. Beyrodtiana*=*Lc. elegans* × *C. Lawrenceana*.—*Lc. Bierredna*=*L. crispata* × *C. Rex*.—*Lc. Bindii*=*L. pumila* × *C. bicolor*.—*Lc. blesensis*=*L. pumila* × *C. Loddigesii*. Sepals and petals a bright rose, lined with deeper color; lip intense purple, marked with yellow. R.H. 1893:424.—*Lc. blutchleyensis*=*L. tenebrosa* × *C. Warszewiczii*. Sepals reddish brown, tinged with greenish yellow; petals bright rose-purple, marked with deeper lines; lip bright rose-purple, lined with purple-crimson. A.G. 23:579. Gt. 55:1555. C.O. 27.—*Lc. broomfieldensis*=*Lc. Clive*.—*Lc. burbanensis*=*L. purpurata* × *C. granulosa*.—*Lc. callistor*=*Lc. callistoglossa* × *C. bicolor*.—*Lc. Canhamiana*=*L. purpurata* × *C. Mossiae*. Sepals and petals light rose, the lip purple, the throat orange, brown-lined, the front lobe white-margined. G. 26:263. G.C. III. 51, suppl. May 25.—*Lc. Canhamiana* var. *alba*. Sepals and petals nearly white. C.O. 19. J.H. III. 45:145; 55:76; 62:565. G.M. 52:867; 57:673.—*Lc. Cantiana*=*Lc. Geo. Woodhames* × *C. Harrisoniana*.—*Lc. Cussandra*=*Lc. elegans* × *C. Loddigesii*.—*Lc. Catherinae*=*Lc. Schilleriana* × *L. longipes*.—*Lc. Celestina*=*L. tenebrosa* × *Lc. elegans*.—*Lc. Charlesworthii*=*L. cinnabarina* × *C. Dowiana*. Fls. light yellow, the narrow lip wavy, purple-marked. G.M. 47:170.—*Lc. chardwarensis*=*L. cinnabarina* × *C. dolosa*.—*Lc. chocophylla*=*L. harpophylla* × *C. Trianae* var. *choceensis*.—*Lc. Cholctiana*=*L. superbiens* × *C. Mossiae*. Sepals and petals light rosy lilac; lip dark rose, the disk yellow, the lateral lobes marked with dark lines. G.M. 45:215.—*Lc. Clarkii*=*L. purpurata* × *C. picturata*.—*Lc. Clive*=*L. pumila* × *C. Dowiana*. Sepals and petals rosy; lip deep, velvety purple, the throat orange-veined. J.H. III. 45:121.—*Lc. Colmaniae*=*Lc. callistoglossa* × *C. Hardyana*.—*Lc. Colmaniana*=*Lc. Arnoldiana* × *C. Dowiana* var. *aurea*.—*Lc. Cooksonae*=*Lc. Clive* × *C. labiata*. Seals and petals deep rosy lilac; lip velvety crimson, suffused with yellow in the center with rich purple lines. J.H. III. 45:375.—*Lc. cornuta*=*L. autumnalis* × *C. labiata*.—*Lc. Coultonii*=*L. tenebrosa* × *Lc. callistoglossa*.—*Lc. Cowanii*=*L. cinnabarina* × *C. Mossiae*.—*Lc. Crainstonae*=*L. tenebrosa* × *C. Harrisoniana* var. *violacea*.—*Lc. crispata*=*L. Hardyana* × *C. Hardyana*.—*Lc. Cybele*=*Lc. elegans* × *C. Trianae*.—*Lc. Davidsonae*=*Lc. bella* × *C. labiata*.—*Lc. Dayana*=*L. crispata* × *C. velutina*.—*Lc. Dengani*=*Lc. Cappei* × *C. Dowiana*.—*Lc. Denisii*=*L. superbiens* × *C. Luddemanniana*.—*Lc. Desgrangeana*=*L. lobata* × *C. labiata*.—*Lc. Dietrichiana*=*Lc. M. Leimann* × *C. Vigeriana*. Sepals and petals intense ruby-red; lip large, velvety, deeper than the sepals and petals, the throat streaked with yellow. R.B. 36:133.—*Lc. Digbyano-Mendelii*=*Brassocattleya Marone*.—*Lc. Digbyano-Schroederæ*=*L. Digbyana* × *C. Schroederæ*. G.C. III. 31:239.—*Lc. Donizetti*=*L. cinnabarina* × *C. Aclandiae*.—*Lc. Dormanæano-aurea*=*Lc. Dormaniana* × *C. aurea*.—*Lc. dourdanensis*=*L. purpurata* × *C. Schroederæ*.—*Lc. Duchesnei*=*L. purpurata* × *C. Schilleriana*. Another hybrid of the same name is *Lc. callistoglossa* × *C. speciosissima*.—*Lc. Duquesnoi*=*Lc. warnhamensis* × *L. purpurata*.—*Lc. Edwardii*=*L. cinnabarina* × *C. Hardyana*.—*Lc. Ehrenbergiana*=*L. Perinii* × *C. Bowringiana*.—*Lc. elegantissima*=*L. cinnabarina* × *C. intermedia*.—*Lc. episcata superba*. A large-fl.-form.—*Lc. Ernestii pallida*. "A pretty form with cowslip-yellow sepals and petals."—*Lc. Ethela*=*Lc. corbellensis* × *C. bicolor*.—*Lc. eversholensis*=*L. cinnabarina* × *C. Forbesii*.—*Lc. exoniensis*=*L. crispata* × *C. Mossiae*. Sepals and petals white, sometimes tinted rosy mauve; lip with the front lobe rich purple, crisped, the narrow margin white or pale mauve; disk yellow, purple-streaked. A.F. 20:527.—There are several different hybrids under this name.—*Lc. Fanyaniana*=*L. tenebrosa* × *C. Trianae*.—*Lc. Farantæ*=*L. purpurata* × *Lc. Pallas*.—*Lc. Fascinator-Mossiae*=*Lc. Fascinator* × *C. Mossiae*. G.C. III. 49:422.—*Lc. fausta*=*Lc. exoniensis* × *C. Loddigesii*.—*Lc. perrierensis*=*L. cinnabarina* × *C. Gaskelliana*.—*Lc. Firminii*=*Lc. Ceres* × *C. Dowiana* var. *aurea*.—*Lc. Flörjii*=*Lc. "Violetta"* × *C. Trianae*.—*Lc. flavola*=*L. cinnabarina* × *C. Schroederæ*.—*Lc. Fleurenæ*=*Lc. Agnes* × *C. Loddigesii*.—*Lc. germania*=*Lc. Cappei* × *C. Mendelii*. Fls. chrome-yellow; lip with front lobe marked earmine-red. G.C. III. 49:325. G.M. 51:413.—*Lc. Godiniana*=*L. grandis* var. *tenebrosa* × *C. Gigas*.—*Lc. Godminii*=*Lc. callistoglossa* × *C. Iris*.—*Lc. Got-*

tena = *L. tenebrosa* × *C. Warneri*. Sepals and petals bright rose, the former shaded with yellowish brown, the petals pale on the margin; lip red-purple, narrowly white-margined. A.F. 23:1047. Gnz. 13:150.—*L. Gotoiana* Herberti is listed.—*L. gracilis* = *L. anceps* × *C. Bowringiana*.—*L. Grogonia* = *L. Dayana* × *C. Harrisoniana*.—*L. Hamiltoni* = *L. Dayana* × *C. bicolor*.—*L. Haroldiana* = *L. tenebrosa* × *C. Hardyana*. Sepals pale yellow, slightly rose-marked; petals yellow, deeply suffused with rose; lip rose-purple, shading to crimson at base. G.M. 45:833 (as var. *superba*).—*L. Harrianeeps* = *L. anceps* × *C. Harrisoniana*.—*L. Harrisoni* = *L. xanthina* × *C. Loddigesii*.—*L. Harrisioni-Schilleriana* = *L. Schilleriana* × *C. Harrisoniana*.—*L. Hastedi* = *L. Greenwoodii* × *C. Dowiana* var. *aurea*.—*L. heatonensis* = *L. Digbyana* × *C. Hardyana*.—*L. Hemptni* = *L. rousensis* × *C. Dowiana* var. *aurea*.—*L. Henrietta* = *L. Greenwoodii* × *C. Luddemaiana*.—*L. Herscilia* = *L. Boothiana* × *C. aurea*.—*L. Hodgkinsoni* = *L. harpophylla* × *C. Mossie*.—*L. Hopkinsii* = *L. Pallas* × *L. tenebrosa*.—*L. Humberti* = *L. majalis* or *L. superbiens* × *C. Aelandie*.—*L. Hursti* = *L. purpurata* × *C. Skinneri*.—*L. Hyana* = *L. purpurata* × *C. Lawrenceana*. Sepals and petals rose-lilac, the sepals more deeply lined; lip entire, the limb nearly orbicular, crenulate-erispate, purple. C.O. 13.—*L. illistris* = *L. Latona* × *C. Dowiana* var. *aurea*.—*L. Imperatrix-Regina* = *L. Martinetti* × *C. Mendelii*.—*L. Ingrami* = *L. Dayana* × *C. Dowiana*. Sepals and petals light rose; lip dark crimson-purple, faintly marked with a lighter hue. J.H. III. 63:267 (as var. *gigantea*). O.R. 4:49.—*L. intermedio-cinnabarina* = *L. cinnabarina* × *C. intermedia*.—*L. inversa* = *L. purpurata* × *C. Warneri*.—*L. Isaacii* = *L. Boothiana* × *C. Harrisoniana*.—*L. Kerchova* = *L. anceps* var. *alba* × *C. Triana* var. *alba*.—*L. labiato-anceps* = *L. anceps* × *C. labiata*.—*L. Ldmbeana* = *L. prestans* × *C. Hardyana*.—*L. Lawrenceana-callistoglossa* = *L. callistoglossa* × *C. Lawrenceana*.—*L. leucata* = *L. harpophylla* × *C. bicolor*. Sepals and petals clear yellow; lip with cream-white lateral lobes, the middle lobe narrow, elongated, purple. G.M. 44:775.—*L. lildana* = *L. Latona* × *C. Pitte*.—*L. Liptoni* = *L. anceps* × *C. labiata*.—*L. Lucasiana* = *L. tenebrosa* × *C. labiata*. Sepals and petals bright violet-purple; lip bright red-carmine, the limb strongly crisped, with brighter lines in the throat. C.O. 25.—*L. luminosa* = *L. Truffautiana*.—*L. Luna* = *L. harpophylla* × *C. Harrisoniana*.—*L. lutea* = *L. Latona* × *C. Ophir*.—*L. Macbeaniana* = *L. anceps* var. *Schroederiana* × *C. Schroederia*. G.C. III. 51:237.—*L. Mardellii* = *L. devoniensis* × *C. Luddemaiana*. Sepals and petals light lilac; lip with the front lobe magenta-purple, marked with deep yellow in the throat. F.M. 1881:437.—*L. Marica* = *L. cinnabarina* × *C. amethystoglossa*.—*L. Marona* = *L. Digbyana* × *C. Waresiewiczii* var. *imperialis*. O.R. 1901:329.—*L. Massangeana* = *L. tenebrosa* × *C. Schilleriana*.—*L. Mauricii* = *L. purpurata* × *C. Triana*.—*L. mollis* = *L. Boothiana* × *C. Mossie*.—*L. Moringstoni* = (?).—*L. Morningtonia* = *L. Pallas* × *C. Fascinator*. G.M. 54:411.—*L. Mossemiliana* = *L. blethleyensis* × *C. labiata*.—*L. Mossie-grandis* = *L. grandis* × *C. Mossie*.—*L. Muelleri* = *L. purpurata* × *C. Canbamiana*.—*L. Mira* = *L. flava* × *C. Triana*. G.M. 47:330. C.O. 10.—*L. Nephelia* = *L. Amesiana* × *C. Mossie*.—*L. nivalis* = *L. glauca* × *C. intermedia*.—*L. Norba* = *L. xanthina* × *C. Mossie*. Sepals and petals white, tinged lightly with yellow; lip rose, with crimson venation. G.M. 46:725 (as var. *superba*).—*L. noctissima* = *L. anceps* × *C. Gaskelliana*.—*L. ochracea* = *L. harpophylla* × *C. Sallieri*.—*L. odora* = *L. purpurata* × *C. Mendelii*.—*L. Olteri* = *L. intermedio-flava* × *C. Percivaliana*, although parentage doubtful.—*L. Pauli* = *L. purpurata* × *C. Schilleriana*. Lind. 784.—*L. Pettersii* = *L. glauca* × *C. Lawrenceana*.—*L. perriosa* = *L. Perrinii* × *C. granulosa*.—*L. Perrino-Mossie* = *L. Perrinii* × *C. Mossie*.—*L. Pisandra* = *L. crispa* × *C. Eldorado*.—*L. Pommery* = *L. elegans* var. *Fournieri* × *C. Mossie* var. *imperialis*.—*L. Pövelii* = *L. Schilleriana* var. *Wolstenholmei* × *C. Mendelii*.—*L. praestans-bicolor* = *L. Binotti*.—*L. Pringiersii* = *L. purpurata* × *L. elegans*. Lind. 750.—*L. Pügetii* = *L. superbiens* × *C. Triana*.—*L. Réx* = *L. Canbamiana*.—*L. rigida* = *L. superbiens* × *C. Lawrenceana*.—*L. Robsoni* = *L. Ingrami* × *C. Bowringiana*.—*L. Roebliana* = *L. xanthina* × *C. elegans* var. *Schilleriana*.—*L. rousensis* = *L. cinnabarina* × *C. Forbesii*.—*L. Rothacheliana* = *L. Martinetti* × *C. Mossie*.—*L. rubiginosa* = *L. Boothiana* × *C. Schilleriana*.—*L. salmonea* = *L. G. S. Ball* × *L. Latona*.—*L. Sandhurstiana* = *C. Ophir* × *C. Hardyana*.—*L. scamptocina* = *L. L. France* × *C. Dowiana* var. *aurea*.—*L. Scherzeriana* = *L. elegans* × *C. rigas* var. *Sanderiana*.—*L. Schiffmanii* = (?).—*L. Schroederi* = *L. Amelia* × *C. Dowiana* var. *aurea*.—*L. schoenobrunnea* = *L. elegans* var. *Turneri* × *C. aurea*.—*L. Schroederacra* = *L. highburyensis* × *C. Schroederia*.—*L. Schwarziana* = *L. blethleyensis* × *C. aurea*.—*L. Signatii* = *L. cinnabarina* × *C. Schroederia*.—*L. Signatii* = *L. elegans* × *C. callistoglossa*.—*L. Shipherdi* = *L. nigrescens* × *C. Dowiana*. O.R. 1906:145.—*L. Skinnerobarina* = *L. cinnabarina* × *C. Skinneri*.—*L. Solangeana* = *L. Perrinii* × *C. Eldorado*.—*L. Stalteriana* = *L. Perrinii* × *C. labiata*. Sepals and petals much like those of *C. labiata*; lip with the base white, crimson-lined, the front lobe dark rich purple. J.H. III. 18:467.—*L. stellata* = *L. xanthina* × *C. intermedia* var. *alba*.—*L. Stipmanni* = *L. corbellensis* × *C. Waresiewiczii* (falter described p. 690, vol. II.).—*L. Steppeselliana* = *L. Andromeda* × *C. Luddemaiana*.—*L. trigymouthensis* = *L. ananda* × *C. labiata*.—*L. tinsgolto* = *L. tenebrosa* × *L. Gotoiana*.—*L. Thibautia* = *L. elegans* var. *Turneri* × *C. Mossie*.—*L. Thurgoodiana* = *L. Martinetti* × *C. Hardyana*.—*L. tigrina* = *L. elegans* var. *prasiata*.—*L. Aelandie*.—*L. Truffautiana* = *L. tenebrosa* × *C. Dowiana*. Sepals and petals yellowish brown, darker lined; lip deep violet-purple, deeper lined, the front lobe narrowly white-margined. C.O. 23. O.R. 10:152.—*L. Vacina* = *L. cinnabarina* × *C. guttata*.—*L. Vldassori* = *L. purpurata* × *C. labiata* var. *Warneri*.—*L. Vriesenpachi* = *L. warhamensis* × *C. Triana*.—*L. Vueliana* = *L. crispa* × *C. labiata*. Fls. lilac; lip with the throat brown-striped, the disk amethyst. *L. venusta* = *L.*

Aphrodite × *L. Schilleriana*.—*L. Vinisia* = *L. tenebrosa* × *L. Phoebe*.—*L. vivicans* = *L. elegans* × *C. Eldorado*.—*L. Watelliana* = *L. crispa* × *C. guttata* var. *Leopoldii*.—*L. Wavrenii* = *L. Boothiana* × *C. Walkeriana*. O.R. 1907:249.—*L. Williana* = *L. purpurata* × *C. Triana*.—*L. Whita* = *L. Vinesia* × *C. Mossie*.—*L. Wigina* = *L. Gotoiana* × *C. Mossie*.—*L. Williamsonii* = *L. purpurata* × *C. mariana*.—*L. Wilsona* = *L. Dayana* × *C. labiata*.—*L. wintonensis* = *L. Mylamiana* × *C. Harrisoniana*.—*L. Wölteri* = *L. pumila* × *C. Gaskelliana*.—*L. Wölteri* = *L. anceps* × *C. Loddigesii*. O.R. 1907:145.—*L. woodfordensis* = *L. crispa* × *L. C. G. Roebling*.—*L. Wrigleyi* = *L. anceps* × *C. Bowringiana*. Sepals and petals rose-purple; lip purple, the throat lighter, purple-lined, and with a touch of yellow. C.O. 33. G.M. 16:795.—*L. Wylandiana* = *L. crispa* × *C. granulosa*.—*L. Zenobia* = *L. elegans* × *C. Loddigesii*.—*L. zephyra* = *C. Mendelii* × *L. xanthina*.

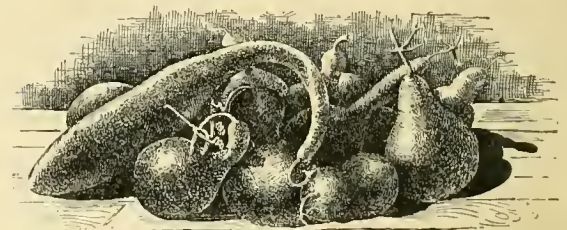
HEINRICH HASSELBRING.

GEORGE V. NASH.†

LAGENARIA (Latin, *lagen*, a bottle). *Cucurbitaceæ*.

GOURD. CALABASH GOURD (the true calabash is *Crescentia*). Probably one species, although several specific names have been given to the various forms: a tender tendrill-vine, producing hard-shelled fruits in very many forms that are used for ornament and in the making of utensils; and the rampant vine makes a good temporary screen or cover.

Plant musk-scented, with a sticky feeling, monoecious or dioecious; fls. solitary, white, funnelliform, very soft in texture, withering in the sun; staminate fls. on very long, slender stalks (usually exceeding the lf.); pistillate fls. mostly short-stalked, with three 2-lobed stigmas and hairy ovary: tendrils forked, long and slender: st.



2059. Various forms of gourds, *Lagenaria leucantha*.

striate-grooved, soft-hairy: lvs. large, soft-pubescent, cordate-ovate or reniform-ovate, sometimes angled, the edges obscurely apiculate-sinuate, on prominent or long petioles. *L. leucantha*, Rusby (*Cucurbita Lagenaria*, Linn. *C. leucantha*, Duch. *L. vulgaris*, Ser.), is widely grown in tropical countries and is often spontaneous; probably native in Trop. Afr. and Asia. To this species belong the gourds known in this country as Hercules' club, sugar-trough, dipper, snake, calabash, bottle, miniature bottle, depressa, and others: see *Gourd*, Vol. III. In some countries, the young fr. is said to be eaten as we eat summer squash.

Lagenaria is a tender annual, which should receive the culture of squashes. The season in the northern states and Ont. is often too short for the full maturity of the frs., particularly if seeds have been brought from the S. Give a quick warm soil and sunny exposure. In the N., seeds may be started inside in pots, or on inverted sods, after the manner of cucumbers. The lagenarias are rampant growers, often running 30-40 ft., and covering the ground or a fence with a dense mass of large, roundish, soft lvs. It is exceedingly variable in its fr., and has received many species-names as *L. microcarpa*, R.H. 1855:61; *L. clavata*; *L. pyrotheca*, R.B. 23, p. 198; *L. virginialis*, white-fruited, G.C. III. 11:85; var. *longissima*, Gt. 48, p. 159; *L. verrucosa*, Hort., with ball-shaped very warty fr., Gt. 39 (1890), p. 106. *L. verrucosa* var. *Giordaniana*, Hort., is a form with warty pear-shaped fr. The hard shells of the frs. are used for drinking-cups, water-jugs, and many domestic utensils. From the pear-shaped shell of a small-fruited form the Paraguayans drink their famous *maté*, or flex tea. Some of the commonest forms are shown in Fig. 2059. The long curved forms

are often called snake gourds in this country (not to be confounded with snake cucumber, which is a *Cucumis*). These are sometimes several feet long. The form with a constricted middle is the bottle gourd. The grooved musical instrument in Spanish Amer. known as guira, guichara or caracho, is made from the gourds (marimbo) of this plant. The South African calabash pipes are derived from this plant and not from *Crescentia*.

L. H. B.



2060. Crape myrtle.—*Lagerstræmia indica*. ($\times \frac{1}{4}$)

LAGENÓPHORA (*flask-bearing*, referring to the shape of the involucre). *Compósitæ*. Small perennial scapose herbs, resembling *Bellis*, allied to *Brachycome*, sometimes planted. Scapes sometimes bearing lvs., slender, unbranched; heads solitary and small, with a short involucre having bracts in about 2 rows; receptacle convex and naked; rays in 1-3 rows, usually white, female and fertile; disk-florets perfect: fr. compressed, more or less beaked, the pappus wanting.—Species about 16, mostly in Austral. and New Zeal., but some in E. Asia and in extra-tropical S. Amer. They are probably adapted to outdoor cult. in parts of the S. *L. Försteri*, DC., the "native daisy" of New Zeal., is described by Cheeseman as a small daisy-like herb, either tufted or with creeping and rooting stolons furnished with tufts of radical lvs. at the nodes: lvs. radical or cauline, the blade orbicular to obovate and 1 in. or less long, coarsely dentate or nearly lobed: scape 1-6 in. long, sometimes with 1-3 minute linear bracts; head $\frac{1}{4}$ - $\frac{1}{2}$ in. diam., the rays white and revolute, numerous. Variable. G.C. III. 49:69. *L. Billardiæri*, Cass., of India and Austral., has lvs. radical or nearly so, oblong or obovate, sinuate-toothed: scape slender, 3-4 in., from a rootstock with thick fibers: head $\frac{1}{2}$ in. diam., with white short rays: variable in size of head.

L. H. B.

LAGERSTRÆMIA (Magnus v. Lagerstræm, 1696-1759, a Swede and friend of Linnaeus). *Lythraceæ*. Showy-flowered shrubs and trees, one of which (the crape myrtle) is much planted in the southern states.

Leaves opposite or the uppermost alternate, mostly ovate, entire: fls. in axillary and terminal panicles, with bracted peduncles and pedicels, pink, purple or white; calyx with a funnel-shaped tube and 6-9 lobes; petals mostly 6, crinkled or fringed, with a long, slender claw (Fig. 2061); stamens many to very many,

long, some of them upward-curved; ovary 3-6-celled, with a long bent style and capitate stigma: fr. a caps.; seeds winged at the top.—Species, according to Koehne (Engler's *Pflanzenreich*, hft. 17, 1903), 30 in S. and E. Asia, Austral., Philippines, New Guinea. The crape myrtle, *Lagerstræmia indica*, is to the S. what the lilac and snowball are to the N.—an inhabitant of nearly every home yard. It is a strong-growing shrub, reaching a height of 10-35 ft., deciduous-lvd., producing an abundance of soft fringed and showy fls. in summer. The normal form has pink fls., but varieties with blush, white and purple fls. are not uncommon. It is hardy as far north as Baltimore, but north of that latitude it needs protection; even with protection it cannot be grown north of the Long Island region. *L. speciosa* is very little grown. Neither species seems to thrive in S. Calif. The many other promising species of *Lagerstræmia* appear not to have been intro. commercially in this country.

indica, Linn. (*L. chinénsis*, Lam.). **CAPE MYRTLE**. Figs. 2060, 2061. Glabrous, smooth- and brown-barked shrub, with rather small (2 in. long) elliptic or oblong sessile mostly acute lvs.: panicle open, sometimes minutely pubescent; fls. usually bright pink, but there are blush, purplish and white forms; calyx not ribbed, glabrous or nearly so. Widely cult. in India, but probably native to China. B.M. 405. R.H. 1857, p. 627; 1874:130. Gt. 6:128; 54, p. 230. G.W. 6, p. 13; 10, p. 109; 13, p. 145. Gng. 1:151; 5:281. A.F. 9:85. F.E. 31:643.—Grown everywhere in the S. Atlantic and Gulf States for its profuse summer bloom, and sometimes it has escaped. The crape myrtle is of the easiest cult. The old bushes bloom profusely, but the plant will produce fls. the first year from seed. The seeds start readily in spring if sown in boxes in autumn and are not allowed to dry out. It is also prop. readily by cuttings of ripe wood. The bloom may be increased by cutting back so that fresh growth is secured. The plant may be grown in a tub or pot in a cool greenhouse, and will bloom 2 or 3 times a year if it is cut back. It has no special soil requirements. In the N. the root may survive if it is well protected, and strong shoots will arise that give bloom the same year. Sometimes the plants are lifted in autumn, carried over winter in a cellar and planted out in spring. As the crape myrtle blooms almost continuously for a period of 2 or 3 months (beginning in June far S.), it well repays what care may be given it under glass or in regions where it is not fully hardy.

speciosa, Pers. (*Munchausia speciosa*, Linn. *L. Flos-Regina*, Retz. *L. Regina*, Roxbg.). Tree, 50-60 ft., with elliptic or long-lanceolate obtuse lvs. 4-8 in. long: panicle large; fls. 2-3 in. across, varying from rose to purple from morning to evening, the calyx grooved, the petals erose-wavy: caps. 1 in. or more long. India. G.C. III. 15:77.—A noble plant in Trop. India; also intro. in S. Calif. In the Old World sometimes grown under glass and on walls out-of-doors.

L. H. B.

LAGETTA (native name in Jamaica). *Thymelæacæ*. **LACE-BARK**. Three W. Indian trees, one of which, *L. linteària*, Lam., is familiar in Jamaica as yielding the beautiful and delicate lace-like material derived from many layers of the inner bark; this material has the look of a gauzy fabric, and it is used in the making of many articles of ornament and use. Sometimes the tree is grown under glass in collections of economic plants. It grows 20-30 ft. high:



2061. One flower of *Lagerstræmia indica*. (Natural size)

glabrous; lvs. alternate, broad-ovate, pointed, 3-5 in. long, evergreen; fls. small, white, in terminal racemes or open lax bractless spikes; calyx tubular-cylindrical, 4-toothed; corolla 0; stamens 8; ovary ovoid, with a single style and broad stigma; fr. small, globose, inclosed in the persistent base of the calyx-tube. B.M. 4502. J.F. 1:19. The lace-bark of New Zealand is a very different plant, *Hoheria populnea* and also *Gaya Lyallii* (Malvaceae). L. H. B.

LAGUNARIA (named for its resemblance to Lagunaea, which is now considered a section of *Hibiscus* and commemorates a Spanish botanist, Andrés de Laguna, 1491 or 1499-1560, physician to Pope Julius III). *Malvaceae*. An Australian (or Norfolk Island) tree cult. outdoors in S. Calif. and indoors in Eu. It has large pale rose fls. like *Hibiscus*, 2½ in. across, with 5 spreading lobes, a column of stamens and a 5-lobed shield-shaped stigma. It differs from *Hibiscus* in having only 3, 4 or 5 deciduous bractlets, while *Hibiscus* usually has 5 or more. Lvs. entire; fls. axillary; calyx 5-toothed; ovary 5-celled.—Species probably only 1.

PATERSONII, Don. Scurfy-pubescent on young parts and inll.; lvs. oblong or broad-lanceolate or sometimes ovate-oblong, 3-4 in. long, white beneath when young; pedicels very short; bractlets at base of fl. 3-5, very obtuse and united; calyx about 1½ in. long; petals narrow, 1½ in. or more long, somewhat tomentose outside.—The Norfolk Isl. form (B.M. 769, as *Lagunaea Patersonia*) is more scaly-tomentose, lvs. broader, and bracts earlier deciduous. They may be different species or botanical varieties. The tree cult. in Calif. attains a height of 50 ft., making a regular pyramidal head and having a fine display of fls.; said to be well adapted to street planting. L. H. B.

LAGURUS (Greek, *lagos*, a hare; *oura*, a tail). *Gramineae*. HARE'S-TAIL GRASS. A hardy annual; spikelets 1-flid., aggregated in a close panicle forming an ovoid head; searious glumes persistent and clothed with fine woolly hairs; lemma with a dorsal awn.—Contains a single species, native of the Medit. region, cult. for ornament, the small white heads being used for dry bouquets. Seeds may be sown in fall and plants set out in spring.

ovatus, Linn. Fig. 2062. Culms tufted, about 1 ft. high; lvs. and sheaths downy. R.H. 1890, p. 488. V. 3:217, 247. Dept. Agric., Div. Agrost. 20:86.—An attractive grass with soft white woolly heads 1-2 in. long.

A. S. HITCHCOCK.

LALLEMANTIA (J. L. E. Avé Lallemand, botanist of St. Petersburg). *Labiatae*. Annual or biennial herbs, of ornamental value for the flower-garden.

From *Dracocéphalum* the genus differs in the character of the upper lip, in which the lateral lobes are on the face of the middle lobe: glabrous or canescent; lvs. opposite, dentate, the upper ones passing into narrow sessile floral bracts; fls. small, blue; calyx tubular, 15-nerved, straight, 5-toothed; corolla-tube slender, inclosed in calyx or some-

what exerted, the throat widening; corolla-limb 2-lipped; stamens 4, didynamous; style 2-lobed; nutlets ovoid.—Species 4, Asia. *L. canescens*, Fisch. & Mey. (*Dracocéphalum canescens*, Linn.), is annual or biennial, 18 in.; lvs. narrow, long-petioled, the floral lvs. sessile; fls. blue, in whorls, with oblong ciliate bracts; corolla-tube exceeding calyx. Asia Minor, Persia. Variable; one form (var. *albida*, Voss) being white. July, Aug. L. H. B.

LAMÁRCKIA (J. B. Lamarck, 1744-1829, distinguished French naturalist, author of the Lamarckian philosophy of organic evolution). *Gramineae*. An ornamental annual grass, often cult. under the name of *Chrysurus cynosuroides* and *C. aureus*. Spikelets of two kinds, the fertile 1-flid., long-awned, surrounded by the long, sterile spikelets of many obtuse glumes, arranged in a 1-sided crowded panicle.—Contains a single species, native from Medit. region to Afghanistan, intro. in Calif. Seeds may be sown in the spring, or better in the fall, and plants set out in the spring. *L. aurea*, Moench. (*Achyrodes aurea*, Kuntze). GOLDEN-TOP. Fig. 2063. Culms 6-12 in. high. R.H. 1890, p. 546. Dept. Agric., Div. Agrost. 20:147.—A handsome grass with oblong feathery golden yellow rather dense



2063. *Lamarckia aurea*. (×¼)

panicles 2-3 in. long. A. S. HITCHCOCK.

LAMIUM (Greek for *throat*, referring to the shape of the corolla). *Labiatae*. DEAD NETTLE. Annual and perennial herbs of the Old World, of which several run wild in this country as weeds and others are cultivated as hardy border plants.

Botanically, *Lamium* is distinguished by a 2-lipped corolla, of which the tube is somewhat longer than the calyx, the upper lip ascending and concave, and the lower one 3-lobed; stamens 4, in 2 pairs, ascending under the upper lip; fls. in axillary or terminal whorls, often rather showy; lvs. opposite, mostly crenate-dentate and petiolate; calyx awl-toothed.—Low herbs, of some 40 species in Eu., N. Afr. and Asia.

Lamiums are diffuse mostly pubescent or hairy herbs, commonly decumbent at the base and often almost trailing. They are of the easiest culture in any open soil. Useful for rockwork. The cultivated kinds are perennial, and are commonly propagated by division.

maculatum, Linn. (*L. album* and *L. purpureum*, Hort., not Linn. *L. variegatum*, Hort.). Straggling or half-trailing perennial, the tips ascending, slightly hairy; lvs. long-petioled (except the uppermost), cordate-ovate, blunt, round-toothed; fls. 1 in. long, ascending in the clusters, the upper lip strongly arched or hooded, the tube 2-3 times longer than the calyx, hairy within. Eu.—Fls. usually purple-red, but sometimes varying to white (when it is known as *L. album*, but the *L. album* of botanists is a different plant, having pointed and sharp-toothed lvs.). The lvs. are usually whitish blotched along the midrib (var. *variegatum*), and in this form it is common about old gardens, trailing in the waste places. The plant is also run wild. *L. purpureum* of the botanists is annual (see suppl. list below).

ericephalum, Benth. St. much branched, glabrous; lower lvs. long-stalked, puberulent, small, orbicular,



2062. *Lagurus ovatus*. (×¼)

somewhat incise-crenate; floral lvs. larger, deeply toothed, sessile or nearly so; calyx villous; corolla 3-4 times longer than the calyx, straight, purple. Taurus.—Said by some to be annual.

Galeobdolon, Crantz (*Galeobdolon luteum*, Huds.). **YELLOW ARCHANGEL**. Perennial, to 1½ ft. high: lvs. ovate, petioled, toothed, only slightly or not at all cordate; fls. yellow, in dense axillary whorls; calyx-teeth short; corolla-tube scarcely exceeding calyx; upper lip long, arched. Woods and shady places, Eu. and W. Asia.—Little cult. in this country.

L. album, Linn., not Hort. Perennial with white fls. in dense axillary whorls: lvs. petiolate, coarsely crenate, sometimes with a white spot in center. Eu., Asia.—*L. purpureum* is a garden hybrid between *L. purpureum* and *L. album*.—*L. purpureum*, Linn. Annual with purplish red fls. in leafy whorls: lvs. small, orbicular, long-petioled, the upper ones short-petioled and ovate: there is a form (*L. incisum*, Willd.) with cut lvs. Eu., Asia.

L. H. B.

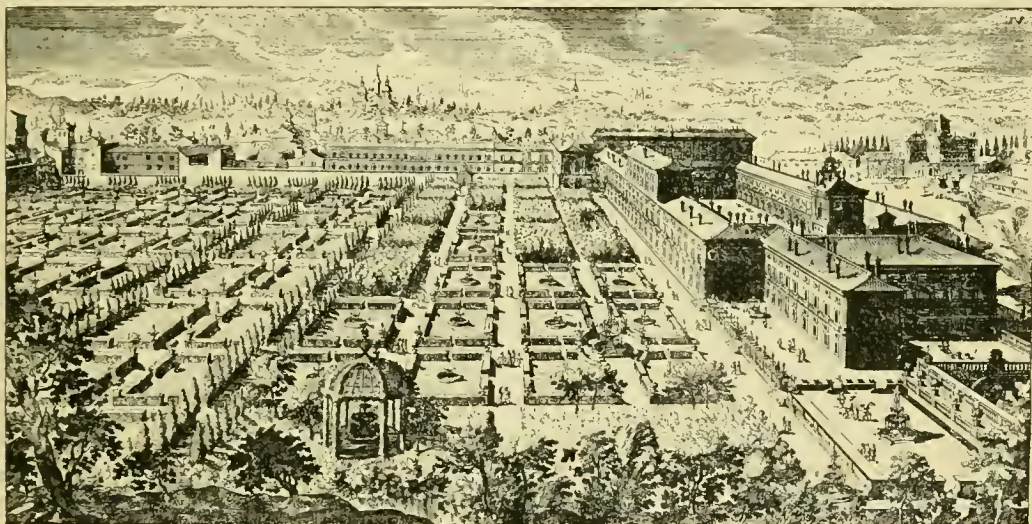
LAMPROCOCUS: *Echmea*.

LANDÓLPHIA (Landolphe, commander of a W. African expedition). *Apocynaceæ*. About 60 species of hairy or glabrous shrubs, mostly climbing by specialized tendrils, of Trop. and S. E. Afr. and adjacent

underlying part of the art. The art of the constructing landscape artist is more than gardening. In this Cyclo-pædia, which deals with horticulture, there is naturally no attempt to cover the subject of landscape architecture; only the gardening or horticultural phases and their implications are considered, and this is why the term landscape gardening is used. This will also explain why many of the important landscape subjects are omitted from this discussion, as city planning, civic improvement, and the like (see *Garden Cities*, page 1313): for these phases are not particularly horticultural.

Here are brought together several discussions on the use of plant materials in the plan of the home ground and in the making of public landscapes. The articles are as follows:

The art of designing landscapes (Manning), page 1783.
The Japanese garden (Tanimura, Verbeek), page 1789.
Formal gardens (Vitale), page 1793.
The landscape treatment of small grounds (Cowell), page 1796.
The landscape treatment of parks (Olmsted), page 1801.
Landscape cemeteries (Simonds), page 1807.
Horticultural phases of civic art (Waugh), page 1811.
Landscape extension (Miller), page 1813.
Lawns and lawn-making in landscape planting (Parsons, Berckmans), page 1816.



2064. Gardens of the Pope, on the Quirinal, Rome. From Falda's "Li Giardini di Roma."

islands, probably not regularly cult. Lvs. opposite, varying in size; stipules wanting; fls. mostly white or yellowish, small to medium-sized, rarely as much as 2 in. long in bud, in corymbs or panicles; sepals 5, free or connate at base; corolla salverform with a short more or less cylindrical tube, the lobes 5; stamens included; ovary entire, 1-celled; stigma conical, 2-lobed: fr. a globose or pyriform body, sometimes large. Some of the species are sometimes mentioned in horticultural literature but do not seem to be listed by dealers in ornamental plants. Most of them are presumably warmhouse subjects. Some of them are rubber plants. See Cyclo. Amer. Agric., Vol. 11, p. 559. L. H. B.

LANDSCAPE GARDENING is the application of garden forms, methods and materials to the improvement of the landscape; and the landscape, in this relationship, is any area, large or small, on which it is possible or desirable to develop a view or a design.

The art that designs and makes landscapes is known mostly by the name landscape architecture, although there is now a tendency to call it by other names. Landscape gardening is the older term; but this term is considered not to be broad enough or bold enough to suggest the large elements of design that form an

"Gardening may be divided into three species—kitchen-gardening—parterre-gardening—and landskip, or picturesque-gardening: which latter is the subject intended in the following pages—It consists in pleasing the imagination by scenes of grandeur, beauty, or variety. Convenience merely has no share here; any farther than as it pleases the imagination." These are the opening lines of "Unconnected Thoughts on Gardening," by the poet William Shenstone, 1764. These sentences probably gave the world the term landscape gardening, to embody the growing desire to make grounds like nature. Milton, Addison, Pope, and the Dutch painters, expressed the awakening to the charms of the external world and hastened the day of freedom and naturalness. These and others had protested, directly or indirectly, against the artificialisms of living, as Bacon, also, in the following sentence, had protested: "As for the making of Knots or Figures, with divers Colored Earths, they be but toys, you may see as good sights many times in Tarts. . . I do not like Images cut out of Juniper, or other garden-stuff; they are for Children."

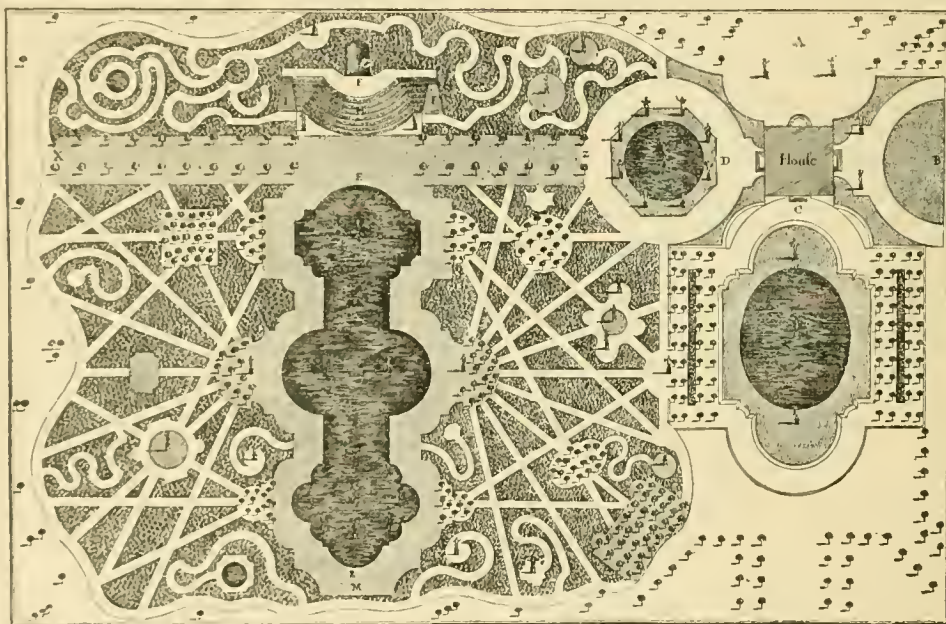
One does not know what Shenstone's protest meant until one knows the style of gardening that had been and still was in vogue. Gardens were fantastic construc-

tions, elaborate with designs and formalities, cramped with geometrical details. A Roman garden (Fig. 2064) was good in its place, but there are other conditions and other ideals. Only infrequently can such gardens as these find the proper setting. If effective, they must be dominated or supported by architecture. In the freer atmosphere of the open country, they are evidently artificial: they are conceits. The reader will catch the feeling of the formal gardens of a later time by looking at Fig. 2065, which is a reduction from one of Batty Langley's designs in his "New Principles of Gardening," 1728. Langley seems to have been the extremest of geometricians. In fact, Part I of his book on gardening treats "Of Geometry." Yet his plates suited the taste of the time. The particular plan which is shown in Fig. 2065 he describes as follows: "The House opens to the North upon the Park A, to the East upon the Court B, to the South upon the Parterre of Grass and Water C; and Lastly to the West upon the circular Basin D, from which leads a pleasant Avenue ZX. The Mount F, is raised with the Earth that came out of the Canal EE, and its slope H, is planted with Hedges of different Ever-Greens, that rising behind one another of different Colours, have a very good Effect, being view'd from M. I, I, are contracted Walks leading up the Mount." The ideas of the time are further reflected in Fig. 2066, which is a reproduction, on a smaller scale, of one of

tion has been left us of the Leasowes. Here is a glimpse: "Passing through a small gate at the bottom of the fine swelling lawn that surrounds the house, you enter upon a winding path, with a piece of water on your right. The path and water, over-shadowed with trees that grow upon the slopes of this narrow dingle, render the scene at once cool, gloomy, solemn, and sequestered; and forms so striking a contrast to the lively scene you have just left, that you seem all on a sudden landed in a subterraneous kind of region. Winding forward down the valley, you pass beside a small root-house, where on a tablet are these lines:

'Here in cool grot, and mossy cell,
We rural fays and faeries dwell;
Tho' rarely seen by mortal eye,
When the pale moon, ascending high,
Darts thro' yon limes her quivering beams,
We frisk it near these crystal streams.'

The garden-art of the old time was largely a corollary of architecture. The garden-art of the present time, particularly amongst English-speaking peoples, exists for its own sake. Yet, one cannot say that the old-time garden-art is unlovely, or that it contradicts the canons of good taste. The two belong to different categories of esthetic feeling, and the mere fact that both of them use plant-subjects does not make them comparable. Garden-art, like painting or music or literature, develops



2065. One of Langley's "Designs for gardens that lye irregularly to the Grand House." 1728.

Langley's pictures of artificial ruins. It is one of his "views of the Ruins of Buildings, after the old Roman manner, to terminate such Walks that end in disagreeable Objects; which Ruins may either be painted upon Canvas, or actually built in that manner with Brick, and cover'd with Plaistering in Imitation of Stone."

The awakening love of nature and of the spontaneous life, as expressed in writings and paintings, soon found expression also in gardens. In verse, Pope gave rules for the laying out of a spontaneous garden. The accompanying plan of Shenstone's garden, the Leasowes (Fig. 2067), and the picture of a glimpse therein (Fig. 2068), show how far his conceptions were removed from those of Langley, howsoever much they may fall short of the ideals of the present day. A full descrip-

tion along racial or national lines. The Latins and their descendants have liked the formal and conventional gardens; and since these gardens express the personal and national emotions, they need no apology, notwithstanding the fact they are condemned by some landscape gardeners.

A different type of endeavor is that which attempts to interpret nature in the making of landscapes. The ideal landscape garden, like the ideal landscape painting, expresses or emphasizes some single thought or feeling. Its expression may be gay, bold, retired, quiet, florid; but if it is natural, the expression will conform to the place and the purpose, and the expressions are not matters of rule. It should be a picture, not a collection of interesting objects. Mere planting and grading do not make a landscape garden: in fact, they often spoil it.

It is not enough to plant: the plants must be in the right place. A yard or a lawn with bushes or flowerbeds scattered over it may be interesting as a mere garden, but it is not a landscape garden. A real landscape garden has open breadth, space, atmosphere. It usually has an open center with mass-planted sides, and vistas to the offscap. Incidentally, it may be ornamented; yet many persons even confound ornamental gardening with landscape gardening: it would be as proper to confound house-painting with architecture.

It will be gleaned from the above that the term landscape gardening precisely expresses the art of making a garden or tame area which shall be a landscape or picture. It is not every place that is adapted to the making of a landscape picture. Formal gardens are often more to be desired than natural gardens. They may conform to the principles of art, but it is the art of formal gardens, not of natural gardens. Too often have formal gardens been judged from the viewpoint of the natural or landscape garden, and hence confusion has arisen. There is now a slow but wholesome reaction against the too exclusive use of the true landscape or "natural" garden. In practice, however, one cannot separate the two, so that one practitioner is, or should be, competent to undertake either or both, although it naturally develops that a practitioner may have special aptitudes and qualifications in one or the other.

Landscape gardening has undergone many fluctuations of taste within a century. Such changes are to be expected as long as the human race makes progress. The constantly increasing wealth in plants modifies the spirit of the work. It is no longer worth while to follow any school or cult. Every style has its use and place. In small places, a formal or formalesque treatment of the ground plan may be desirable. In larger and freer places, the spirit of the fields may be given fuller expression. The fundamental consideration is that there must be a general theory or plan before any grading and planting takes place or structures erected, —these latter parts are only means to an end. Yet many persons who would be called landscape gardeners conceive that to plant a place is the whole of the problem. The working out of the details of the plan is to landscape gardening what building is to architecture, or what pen-work and grammar are to literature. It is the industrial or constructional part of the work. It is what has been called landscape horticulture (Bailey, "Garden and Forest," 1:58). It has to do with all the details of kinds of plants, the care of them, the making of lawns, and similar problems. The American writings on landscape gardening are mostly writings on landscape horticulture and kinds of plants.

A marked development of landscape art in recent time is the application of it to very small and plain home grounds and to secondary civic areas. Even the back yard of the tenement is within its range (Fig. 2075). This is an illustration of the extension of social democracy.

The practitioners.

The first American practicing landscape gardener of note was apparently André Parmentier, who came to this country from Belgium about 1824 and established a nursery on ground which is now in the heart of Brooklyn. He was a man of great taste and skill, and Andrew J. Downing considered his "labors and example, as having effected, directly, far more for landscape gardening in America than those of any other individual whatever." He laid out many places, even as far away as the southern states on the south and Montreal on the north. The first American book on landscape gardening was from the pen of A. J. Downing in 1841, without having undergone the tedious evolution of preliminary and imperfect editions which characterize so many horticultural and kindred writings. It was immediately popular, and exerted a great influence on American

horticulture. Downing was also the second prominent practicing landscape gardener, although his untimely death left the country with no completed works of his genius. His best known public pieces are the grounds of the Smithsonian Institution and Lafayette Square, Washington, but it is doubtful whether the subsequent treatment carries out the spirit of the designer. A. J.



2066. An improvised ruin. 1728.

Downing's pomological work was continued by his painstaking brother Charles; but the artistic work dropped at his death, and Henry Winthrop Sargent, who edited the sixth edition of the "Landscape Gardening," in 1859, declared that "there has been no one since Mr. Downing's death who has exactly filled the niche he occupied in the public estimation." Ignatz A. Pilat, an Austrian by birth, was early chief landscape gardener of Central Park, and a general practitioner of influence following Downing.

The subsequent genius of American landscape gardening, and the one who carried the art to its highest points of excellence, is Frederick Law Olmsted, who as a young man was inspired by Downing, and who became a landscape gardener when he was placed in charge of the improvements of Central Park, New York City, about 1856. For more than thirty years, Mr. Olmsted gave his talents wholly to this delightful art, and, more than any other American, moulded and crystallized public taste respecting the appreciation of landscape gardening. A leading spirit in the construction of this great park was Calvert Vaux, who, with Olmsted, was joint author of the original plan. Vaux was also associated with Downing. The initiation of Central Park as a pleasure-ground inaugurated the modern park systems of the country, and created what the Earl of Meath has designated the "veritable rage for park making" which has "seized the American public."

Within recent years, the number of practitioners of landscape gardening has greatly increased. The art is established in popular estimation. It has now fairly won its place, also, with the architects and artists. Tastes may change, but the changes will affect only the minor applications of the art. The desire for artistic treatment of grounds is ineradicable. Two national societies are conservators of the landscape gardening and rural art of the country: American Society of Land-

scape Architects, American Association of Park Superintendents. Other societies are also related to landscape art, as the American Civic Association, American Scenic and Historic Preservation Society, and the horticultural bodies. The subject is also taught in colleges in its amateur aspects and in a few places professionally. The discussion of city-planning has now taken hold of the public imagination, although little has yet been done to visualize the necessity of country-planning.

The kinds of landscape gardens.

The improved landscape, we have said, may be large or small. It may also represent any condition of residence or of public use. The illustrations herewith indicate, better than words, some of the merits and some of the possibilities in landscape. (Many of the illustrations have appeared in "Garden and Forest.") The improved or designed landscape area should appropriate the good views and scenes beyond itself or adjacent to it. The distant view in Fig. 2069 should not be missed from any landscape garden if one is so fortunate as to be in the region of such an offscape. Even familiar objects, as a spire, a distant residence, a well-proportioned bridge (Fig. 2070), a noble tree, may add much interest if brought into the home landscape by means of vistas. It would be a special good fortune if the landscape garden could lead into any kind of a wood or forest, particularly into anything so distinctive as the Jersey pines shown in Fig. 2071. In many places, the grounds may lead off naturally into an informal country road (Fig. 2072), which is always interesting with its irregular lines, variety of life, and stimulating suggestions. A stream is always an entertaining boundary, particularly when a walk may follow it, as in Fig. 2073.

America excels in landscape art applied to the rural and garden cemetery. The first distinct movement toward a rural cemetery was made in 1825 by Jacob Bigelow, of Boston, whose work was soon taken up by the Massachusetts Horticultural Society. As a result of the agitation by this admirable organization, Mt. Auburn Cemetery, at Cambridge, was established and incorporated in 1831. The consummation of this enterprise gave to the world a cemetery distinct from churchyards, removed from the city, and softened by the gracious touch of nature; and thereby, also, the young Massachusetts Horticultural Society set an example to all similar organizations and achieved for itself enduring fame. The work of Repton and Loudon had not then

enlivened and broadened the conceptions of landscape gardening, and Mt. Auburn, whilst an excellent work of its kind, is not a landscape-garden cemetery. The modern art of garden-cemetery making—in which, as in the park, the continuous expanse of greensward is the fundamental conception of the fabric—originated with



2068. Glimpse in Shenstone's Leasowes. Page 1778.

Adolph Strauch, who, in 1854, became superintendent of Spring Grove Cemetery, Cincinnati. Strauch's work at Spring Grove Cemetery has justly given him lasting fame, and his book describing the place must be consulted by anyone who traces the evolution of the garden-cemetery. The Board of Directors of the cemetery said, at the time of his death, that "he had filled the measure of his ambition by the consent of his profession, which ranked him as the equal of Repton and Pückler-Muskau as a master of art in landscape creation, which had been finally proved by him to be possible to be successfully applied in adorning and making attractive the last resting-places of humanity." At present, about one hundred or more burial-places in various parts of North America can be said to be landscape-garden cemeteries.

The successful practice of landscape gardening depends, first, on an artistic temperament and an inherent love of nature; second, on an intimate knowledge of plants; and third, on familiarity with various arts and handicrafts, as the making of roads, grading, draining, enriching the land, and the like. Landscape gardening must be sharply distinguished from gardening: the former is the making of pictures with plants; the latter is the growing of plants without reference to the picture. In one, the interest centers in art: in the other it centers in plants. Since landscape gardening is primarily a matter of taste, it is impossible that it be dominated by arbitrary rules. However, a few general precepts and suggestions may be useful.

The motive of a true landscape garden, as already explained, is to make a picture. The picture should have a landscape or nature-like effect. The place should be one thing: it should emphasize some thought or feeling. It should have one central or emphatic object, and avoid scattered effects. In general, the advice is to bunch or mass the planting. One must distinguish sharply between the fundamentals and the incidentals,—those conceptions that are to give the character or tone to the place, and those that are embellishments or ornaments. In usual practice it is essential to keep one or more spaces open, and to plant the sides or boundaries with masses. The use of single or individual plants is only to emphasize or to heighten an effect, not to give it character: they are incidentals. Ornament should be an incident. Foliage and verdure is a fundamental requisite. In natural sod regions, greensward is the canvas on which the picture is spread. Plants are more



2067. Plan of the Leasowes, the seat of Shenstone. The residence is near the center. Page 1778.



LXII. Example of the large rural park.—View in Prospect Park, Brooklyn.

useful for the positions they occupy than for their kinds. Walks and drives are no part of a landscape picture: they are a necessity, but they may be made to conform to the spirit of the picture, and also to add human interest to it. The place for walks and drives is where they are needed: otherwise they have no use or purpose. It is the part of a good landscape gardener to make his grounds conform to the buildings: it should equally be the part of an architect to make his buildings conform to the landscape. There should be views to desirable objects in the outlying landscape or the offscape. The undesirable parts or views should be covered. The designer should aim for a good prospect from every window in a residence, including the kitchen. The trees and bushes are sheared only when hedges, curiosities, and formal gardens are wanted: they assume their natural forms when a landscape garden is wanted (Fig. 2074). No tree or plant is placed until one is sure that it will mean something and add to the total good effect.

The open center is possible even in very small areas. Fig. 2075, for example, shows the principle applied to an ordinary city back yard. The planting is massed against the fences, and a free space is secured for other purposes. In a larger way, the open center is admirably illustrated in Fig. 2076. Again it is shown in a parking plan, Fig. 2077.

It is not to be assumed, however, that the principle of the open center is to apply invariably, or that it is always to face the direction of the public view. The planting may be disposed specially for the purpose of screening from the highway, and it may have artistic merit of its own. Fig. 2078 shows a good screen-planting, and it is well adapted to the character of the residence. Yet even in such cases as this, the open center may be an essential feature of the design, but it may face inward, and constitute an interior open space, rather than outward. Rather close and intimate planting may accentuate the character of a very personal or special residence, and a very open feature may detract from the interest. In such a case as that shown in Fig. 2079, for example, a rather heavy planting about most of the building would probably heighten the interest. This is a construction that suggests seclusion. Even with the open center, however, the bases and angles of buildings may be well tied to the lawn-surface by planting.

In city openings and certain other places, the open center may be no part of the plan. Here the only purpose may be to provide shade, shelter, and seating-space. In some cases, only a promenade is desired. The landscape, in the artistic sense, comprises these areas as well as those in which it is possible to secure a pictorial presentation with some completeness or wholeness of effect. Every open space, in city, village or open country, may find improvement under the hand of the landscape artist. Even the wharving or dock area of seaports, which are perhaps the least likely places for landscape work, may afford space and opportunity for artistic treatment; Fig. 2080, being a design by W. Hamilton Bell, is a suggestion of this kind.

Historic and important places.

Many estates and country-seats have contributed to the development and establishing of taste in landscapes in this country, particularly in the eastern states. It requires age to bring out the essential qualities of an estate. When a person builds a house of some pretension and plants the grounds on a design, he is anxious at once to photograph the effort; the result is that our periodicals are full of pictures of immature and undeveloped places.

There is need of a careful and sympathetic study of the historic estates in North America, as a contribution to the development of taste in both architecture and landscape treatment. The study should include

the estates of the far Southwest and the Pacific coast, that represent the Spanish influence. At this place, only a few of the notable estates in the eastern part of the country may be mentioned. They naturally represent the English influence and the background of greensward.

In many respects, Mt. Vernon stands first. It remains a wonderful example of the satisfactory use of a landscape. Hyde Park, the Vanderbilt place on the Hudson, is one of the estates notable for its landscape features; also the Morton place at Rhinecliff, on the Hudson; Wodenethe, the H. W. Sargent place at Fishkill; Holm Lea, the estate of Charles S. Sargent at Brookline, Massachusetts; the Twombly place, in New Jersey; the Hunnewell estate at Wellesley, Massachusetts; Irving's country-seat, Sunnyside, on the Hudson; Jefferson's home, Monticello, Charlottesville, Virginia; the Drayton estate near Charleston, famous for its azaleas; the Middleton place on the Ashley, near Charleston, where early plantations of camellia were made;



2069. A worthy offscape.—Lake Yumoto, Japan. Page 1780.

old estates on the James River, as Westover and Brandon; the great Vanderbilt place at Biltmore, North Carolina. There are many others. Mention might also be made of the Bartram estate in what is now Philadelphia, for while it was never a landscape garden, it has contributed much to the stimulation of interest in trees; and its historic value is great. See the biographical note on Bartram, Vol. III, p. 1564; also the references in Vol. I, p. 348.

Some of the above places are prized chiefly for their horticultural features, in relation to landscape, rather than for the fundamental design. The Hunnewell estate is remarkable in this feature. The places laid out under the inspiration of A. J. Downing were notable for their planting, although there are few of these estates now remaining. It is probable that Downing's influence persists in some of the older places even if unrecognized by present owners and visitors. Downing admired the rural gothic in domestic architecture, and the change in taste in this direction has undoubtedly had something to do with the loss of interest in his landscape work. His untimely death prevented him from making a great impression in the way of actual examples. Downing had a real love of plants, and his knowledge of trees was remarkable and unusual among Americans of his time. His regard for trees was notable, and he knew their possibilities in the reconstructed or

planted landscape. His ideas and his tastes were communicated to his friend and neighbor, Henry Winthrop Sargent, who transmitted them to another generation, and some of the most interesting and beautiful country places made in America in the last sixty years owe their existence to Downing's influence. It was this influence



2070. A commanding object in the offscap.

which has made the Arnold Arboretum what it is, a natural garden of great beauty and not a mere collection of trees and shrubs. It must be remembered, also, that when Downing died the only public grounds in the United States which could in any sense be called a park was Boston Common, and that it was through his knowledge and influence that Central Park in New York was established in 1852; and it was Central Park that led to the establishment of public parks and playgrounds in every American city.

The artistic values in some of the old places, and the reasons for them, are discussed by Warren H. Manning, in the remainder of this introductory article.

"The principal lesson to be learned from a study of historic private estates in America is the fact that our system of land tenure does not lead, as does the English method of entailment, to the holding by a family of such estates for centuries. While there are many houses and some large property holdings in the older parts of this country that have remained in one family for many generations, even back to the period of the original grant or purchase, they are usually not notably fine estates. There are very few, if any, of such estates upon which the first acreage or the original design and intent of the founder have been continued in all essential details for three or four generations.

"Mount Vernon, under the ownership of an association, has been maintained much as it was designed by General Washington, although the original acreage of the property has been much curtailed since Washington's day, and the planting is now being restored. Such associations as the Virginia and Massachusetts societies for the preservation of antiquities, and the several colonial societies have rescued, restored and are maintaining many old homes with but a fragment of the original estate attached. Some cities are maintaining historic homesteads as public museums or in public parks, as New York holds the Van Cortlandt homestead in Van Cortlandt Park, which includes parts of the old estate diverted to other than its original uses.

"Family associations have been formed to hold the ancestral homes with a small part of the original farm holdings, such as the Fairbanks, Wyman, and Manning associations in Massachusetts. The United States Government holds Arlington, the home of Robert E. Lee, with most of the land diverted to other than the original use. The Pendleton house in Providence, Rhode Island, and the Swett house in Portland, Maine, are held as typical furnished homes of their day in association with art museums through the bequest of the last owners.

"This brief review indicates that it is the historical antecedence, not the beauty of landscape and gardens, that is responsible for the preservation of most of the ancient homes and estates, notwithstanding that the beauty of landscape determined the location and first design of many of the early homes and the grounds about them.

"There are two broad distinctions to be made between the notable properties of the North and of the South.

In the South, the great estates included acres by the thousands with the extensive cultivation of great fields, while in the North the acres seldom ran into the hundreds, and the cultivation was usually more intensive. In the South, there was a comparatively small proportion of the property set aside about the mansion for lawns, gardens and other ornamental purposes, as compared with the homes of the North. In the South, the home buildings were usually broadly spread out, with symmetrical wings on each side of a main central structure. In this central structure, the use of the tall columns of the classic order, with either a projecting or a recessed portico or porch, was almost universal. However, there was a marked individuality in most of the buildings and a fairly well-marked distinction between two types of design that have been referred to as the Georgia-Colonial and the Virginia-Colonial, the distinction of the latter style being due chiefly to the work of Thomas Jefferson which was typified by his own home, Monticello, and by his University of Virginia.

"In the North, the mansions were usually carried a story or more higher than in the South. They were more compact and restrained, for pilasters were used very largely in the place of columns. Instead of the balance of wings on either side of the main structure, the wing was usually added at one side or at the rear, and extended to include the various outbuildings and shops with stables forming the terminus of the group, or being rather closely associated with the house in a group near at hand; whereas in the South the workers' houses, the plantation barn, and the shop for the wheelwright, blacksmith, the cotton press, and sheds for the drying of tobacco, were in separate groups at some distance from the mansion.

"Before the Revolutionary period, and for a quarter of a century afterward, the English influences in the design of estates, both North and South, were very marked. Within this period Thomas Jefferson's influence, not only in the design of buildings but also in the design of grounds, was powerful in the South, and especially in Virginia. At the end of this period André Parmentier exerted an important influence in the North, especially about New York.

"In this colonial period and subsequent to it, there was an exchange of native and exotic plant material, through such men as John Bartram, Peter Collinson, Benjamin Franklin, Thomas Jefferson, and others,

supplemented by such agencies as the Prince's Nurseries at Flushing, Long Island, and the Winship Nurseries at Boston. This interest was reflected in the writings of A. J. Downing, the first notable writer and practitioner in the designing of landscapes, whose successor, Frederick Law Olmsted, initiated systems of parks that preceded the city-plan movement of today. This period of testing exotic plants and



2071. A good background for a landscape garden. Page 1780.

fruit trees in private grounds and in a few public parks, that extended through the middle and latter part of the last century, established the fact that many of these varieties were too short-lived to be of permanent value. Others thus secured not only an established place in our gardens by reason of their adaptability to our conditions and their evidence of long life, but also a permanent place in our flora by becoming naturalized in fields and woods of both the North and South. This experience in exotics was followed by an interest in the natives of both the East and West of the United States, which has led to their use in nurseries and in gardens. In recent years, new groups of exotic plants and more of our native plants, are coming into general cultivation through the interest of Professor Sargent and the Arnold Arboretum, where a careful test is made before the plant is recommended for general use, and through the Department of Agriculture at Washington, and the Experimental Farms of Canada. Through these various agencies, an important part of whose support has always come from the owners of large private estates, a very large share of the earth's surface has been searched for new varieties.

"There are, therefore, represented in the great private estates one group in which special attention was given to the growing of collections and fine specimens, such as Wodenethe, the Sargent estate on the Hudson; Glen Cove, the estate of the late Charles A. Dana at Glen Cove, Long Island; the Payson estate in Belmont, Mass.; and the Hunnewell estate at Wellesley, Mass. In another group, the beauty of landscape was the dominant motive in design and maintenance, as represented by the Montgomery place south of Clermont on the Hudson, which was regarded by Downing as being second to none in America, and by Charles Eliot was placed among the first in his series of articles on "Some Old American Country-seats" in "Garden and Forest." In this same class would be the A. T. Lyman and Christopher Gore estates in Waltham, Mass. (Fig. 2076); Sunnyside, the Washington Irving place on the Hudson; Monticello, Jefferson's homestead at Charlottesville, Virginia; and the Arlington estate, the home of Lee near Washington.

"The work on the large private estates of the future should and probably will be on broader and more definitely directed lines than was represented by the great estates of the past. While there will always be individuals who prefer to make collections of interesting specimens, such owners will be able hereafter to avoid duplication of effort and work with clearly designated groups of plants, or secure more tangible return through plant-selection and plant-breeding by cooperating with such agencies as the Arnold Arboretum, the departments at Washington and Ottawa, and state institutions, instead of attempting to record and establish great general collections.

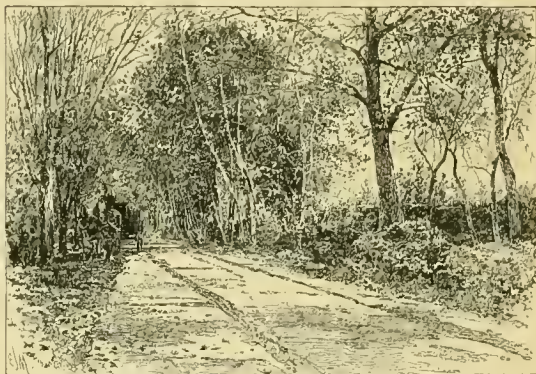
"There will be a group of individuals whose chief interest will center in the development of landscapes in a very much broader way than has been the general practice of the past, and which is indicated by the development of town park systems and town plans, and will be enlarged to include a national plan that will fit the lay of the land.

"The express train, automobile, and the aeroplane to follow, are training the eyes to see real landscapes more and the details of landscapes less. This breadth of view will lead men to become connoisseurs of the living landscapes instead of the painted landscapes alone. It will lead men to seek out the choicest landscape views and purchase them, and to acquire or control in these outlooks the essential features instead of attempting to acquire all the land for themselves."

Literature.

The best results in the planning of any place are to be expected when one employs a competent landscape

gardener. Avoid the man who places great stress on flower-beds and unrelated designs. Yet one can do much by himself, and be the happier for the effort. Books will help. Some of the current American books on gardening as related to landscape are the following: Downing, "Landscape Gardening;" Kemp, "How to Lay Out a Garden;" Parsons, "Landscape Gardening," and "How to Plan the Home Grounds;" Long, "Ornamental Gardening for Americans;" Waugh, "Landscape Gardening" and "The Landscape Beautiful;" Maynard, "Landscape Gardening as Applied to Home Decoration;" Davis, "Ornamental Shrubs;" Van Rensselaer,



2072. An interesting marginal road. Page 1780.

"Art Out-of-Doors;" Bailey, "Manual of Gardening;" Underwood, "The Garden and Its Accessories." See *Borders, Banks, Garden, Herbs, Shrubs*, and other articles. The home vegetable-garden and flower-garden are discussed in Vol. III, p. 1738, p. 1747. L. H. B.

The art of designing landscapes.

Landscape gardening is one of the terms used to designate the profession that conserves, develops and creates landscape, locates and arranges artificial structures, plantations, and passages therein for the convenience and pleasure of man. It is practised professionally as a fine art by men and women who have also adopted such titles as landscape architect and landscape designer; and by some architects. It is practised as a part of their duties by some superintendents of public and private grounds and made a part of their business by some dealers in plants.

This landscape art may include all objects within the scope of vision, from a narrow strip of sky and foliage between buildings, a lawn, a garden, a town, to a horizon-sweeping panorama.

In this, as in all professions, many are mere copyists who, in all their problems, duplicate or adapt with minor variations, styles, plans and patterns originated by others to meet the special requirements and conditions of each of their problems.

The artists of the profession as well as artists among painters of landscape are striving to give a quality of distinction to each of their productions. This distinction comes from a study of the distinctive beauty of the locality in which they work; a beauty that may be partly or wholly hidden by extraneous material. The designer of the living landscapes must also acquire a knowledge of the conditions and requirements of the use to which all or parts of their landscape is to be put by its occupants. The landscape painter is free to choose his subject while the landscape-maker often must create a new beauty in wholly artificial landscape compositions. Artistic distinction of design is gained through the omission by the painter or removal by the landscape-maker of extraneous material and incon-

gruous incidents and by additions that will give greater harmony and unity.

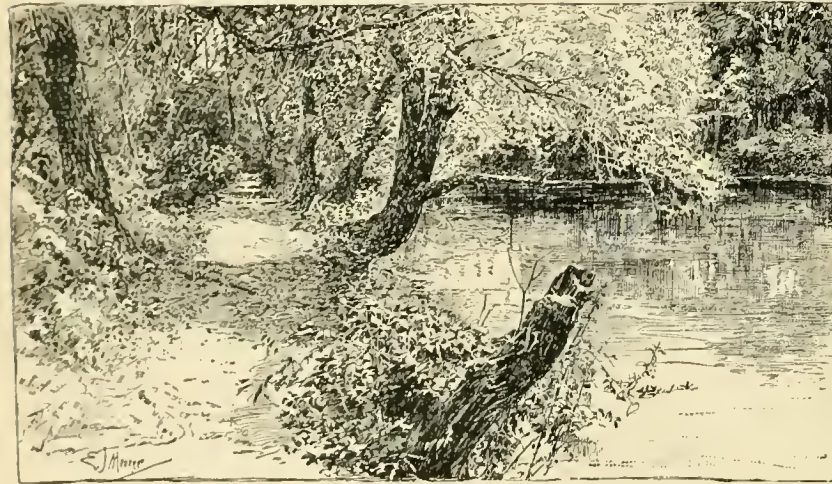
The principles of design in this art of landscape-making are very similar to those of the landscape painters who can produce on canvas phases of natural beauty with such skill as to give great pleasure to the eye, and sometimes a stimulus to the imagination that is the gift of genius alone. Every student and lover of the living landscapes should study the pictures of the Barbizon School and of such artists as Hobbema, Claude Lorraine, Turner, Fragonard, Corot, Constable, Inness, Church, and Wyant. Church and other painters have chosen for their subjects passages in the wholly artificial landscapes of New York Central Park that was designed and constructed by the senior Frederick Law Olmsted, who was the great master of the artists who design living landscapes.

While there is as yet no accepted distinction between the landscape works of those who practise under the different titles referred to, the names suggest a distinction that may be helpful in outlining various phases of professional work.

Landscape architecture.

Landscape architecture, the French term for the profession, could be properly applied to the designs that formalize landscape in a large way, as did Le Notre's at Versailles, or to big formal gardens of today filled with architectural structures or architectural and sculptural brie-a-brac wherein foliage and flowers serve only to relieve the rigidity and severity of such immobile forms.

The term landscape architect was first applied by



2073. A boundary stream and walk. Page 1780.

the New York City Central Park Commission on February 20, 1862, to their advisers, Frederick Law Olmsted and Calvert Vaux, and was retained by Mr. Olmsted in his later practice and adopted by a majority of his successors, notwithstanding the fact that the dominant spirit of American work is essentially informal. By informal in landscape gardening is meant naturalistic design in which irregular massing of the landscape elements predominates. By formal is meant design depending on a more exact symmetry.

There is a spectacular impressiveness in big formalized landscapes and gardens that is sure to elicit the brief admiration of the multitude. There may also be a beauty in proportion, a justness in scale, and a refinement of detail that will satisfy the discriminating critic, and give pleasure even to those whose greatest satisfaction comes from the greater variety and intricacy of

informal and natural beauty. There are situations in which the formal treatment is undoubtedly best.

In formal design the land is forced to fit the plan; in informal design the plan is made to fit the land.

When there is abundant means properly to construct and maintain large formal layouts, they may with propriety be introduced in public parks and private show estates, especially in direct association with great buildings and their formal entrances and courts.

At the other extreme of formal design are the old-fashioned gardens with box-edged walks symmetrically arranged in a pattern that gives convenient access to beds.

Another distinctly informal garden type, the Japanese garden, is referred to here because it is so artificial in design and in construction. These gardens are conventionalized miniature landscapes. They may include miniature mountains with ancient, wind-swept, stunted trees, cliffs, ledges, turf, and water, or the imitation of water made in sand, edged or crossed by suitably placed stones. Very distinctly do these gardens appeal to the imagination. There is also a special sentimental significance given to the form and arrangement of such garden features as lanterns, seats, groups of stones and plants, similar to the significance of flower-stem and fruit arrangements in Japanese homes made to convey expressions of sentiment, courtesy and compliment to guests and friends. While we cannot reproduce a genuine Japanese garden with our materials, we may make our gardens appeal more to the imagination in expressing certain types of our own landscapes, and more to sentiment in establishing a recognized significance for the incidental structures therein.

A garden, formal or informal, in which especially favorable conditions are established for the growth of fine garden flowers, should have a place in grounds where the surpassing interest is not given by some natural feature. It is desirable that such gardens be entered so directly from a home as to become outdoor compartments of it.

The design of small house grounds, small shut-in estates, and public grounds will fluctuate in style from period to period between the bondage of the rigidly formal to the freedom of informality. Nature's modeling of the surface in broad landscapes can never be greatly modified except by the introduction of artificial

bodies of water, and by the arrangement of masses of foliage, of fields and of habitations as seen from selected viewpoints.

Landscape design.

Landscape design, a term as yet adopted by few practitioners, could properly be applied to the development of the broad landscapes and passages of natural beauty. Such beauty can be modified and enhanced but can rarely be reproduced by man or his money within a short time limit, as can be the lawn and the garden.

In the selection, development and refinement of broad landscape beauty, there would be little of the formality that has been mentioned as especially appropriate to the term landscape architecture, little of the new construction and exotic planting to be referred to later under landscape gardening.

Broad landscapes vary greatly in impressiveness and beauty from different viewpoints, even within a limited area, and the first problem of officials representing public ownership, or a private owner, before arranging with engineer or architect for detailed structural plans, is to choose with his landscape adviser the finest of the

choice holdings of individuals will be devised to cities or to the nation as paintings and sculptures now are.

This work of the landscape designer wherein it is deemed more important to preserve and develop natural beauty than to destroy it and substitute artificial beauty, applies as well to the little home ground upon which natural beauty exists as to great estates or to great landscapes.

Landscape gardening.

Landscape gardening or gardening, the English term for the profession, now and in the period when such classics as Wheatley's "Observations on Modern Gardening," Price's "On the Picturesque" and the works of Repton and Gilpin were produced, is a term that may properly be applied to such distinctly horticultural phases of the profession as may be treated in detail in an horticultural cyclopedia. The term may well have special application to landscapes that must be largely or wholly artificial, in which the planting is chiefly the product of horticultural establishments. Such landscapes are represented by the average small park and the intimate home outlooks of lawns and gardens, rather than by the wild woods, the fields and the wide views.

If the landscape be only a single window outlook in a city block against bare walls with just one opening in which appears a graceful tree or vine branch, silhouetted against the sky, the artist will so arrange plants and vines about his window-frame as to shut out the bare walls and make the sky and the branch the central attraction of his picture. Here may be gained as much pleasure from hourly changes in the sky background, seasonal changes in the foliage, and from the occasional bird or butterfly visitor, as many a rich man gains from his galleries of paintings and acres of gardens. For suitable selection of vines in shade or in sun to execute the artist's ideals for the frame about a window-opening and for the flowering plants to be used in association with the vines, one would look to the local florists' establishments.

The main subdivisions of the average house-lot are usually lawns, garden, laundry and service-yard and house and service entrance walks, or if the lot is large enough, these walks may be roads. (Fig. 2081.) The lawn and the garden should by preference be on the sunny side and directly associated with and entered from the home living side of the house. The service or utility entrance passages and compartments are usually placed on the shady side. It was once regarded as essential that the living-room be on the street side of the lot and the service-rooms at the back of the lot, regardless of exposures or outlook. It is now regarded as the best practice to give the living-rooms the most attractive exposures and outlooks regardless of the street, and to place service-rooms and yards next to the street, or at the side of the lot when this arrange-



2074. Good plant forms for the free style of design. Page 1781.

various available and accessible viewpoints. This would involve a study of the far distance, the middle distance, the foreground and the nearby foliage frame, of each of the sites that can be arranged conveniently to meet the needs of the public or the owner. In such study it may be often developed that the property purchases should include distant single trees, groups of trees, or forests and fields that may be quite separate from the main property and be held because they are essential elements in the beauty of the outlook.

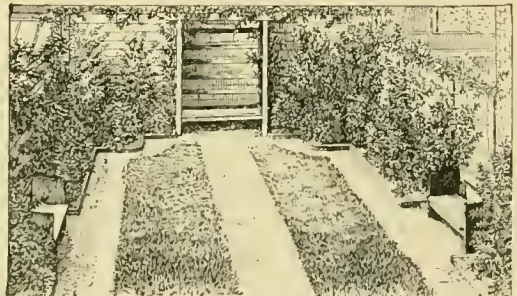
Another landscape of distinction would be a woodland glade walled in by splendid old trees, each one a patriarch with a ripened beauty and dignity that age only can give, the forest floor covered with an exquisite carpet of such evergreen trailing plants as *linnea*, wintergreen, bearberry, ferns and mosses, all having a refinement of detail that comes only with years of natural selection and adaptation to such special conditions.

In the development of such a forest retreat, foliage- and branch-framed pictures would be opened up into the woods or to fields or distant sky-lines beyond by carefully studied tree and branch removals. The beauty of adjacent woodland detail, such as a shrub or herb group in which one variety predominates, would be enhanced by the removal of other plants that interfere with a foliage and stem, floral or fruit composition already having or promising to have marked distinction. In other places the varieties elsewhere removed would predominate and be the ones retained and fostered.

Such notable broad landscapes or woodland passages will be seen by the owners and observers from the buildings or grounds of a resort or from a home about which would be the gardens and fields of utility and beauty that are needed to sustain and give pleasure to many persons.

The time will also come when persons of advanced taste will have their collection of living landscapes with simple retreats from which they and their friends can enjoy each scene. The automobile now makes it feasible to have such possessions in widely separated locations, and the cost of acquiring and maintaining such living pictures need be no greater than is often devoted to painted pictures.

Already nation and cities are beginning to preserve and acquire fine scenery in public reservations, and



2075. The open center in a small rear lot. Pages 1779, 1781.

ment gives the advantage to either living-grounds or -rooms. Such service compartments may be screened from the public gaze by lattices covered with vines or shrub plantations. Examples of such exceptional but sensible layouts are shown in Fig. 2082.

From lots surrounded by houses and back yards are likely to be one or more outlooks that are similar to and can be treated like the narrow window outlook referred to above. When views are to be seen from several positions in house and grounds and at various heights, the arrangement of the boundary foliage-frame as well as the planting about the house, gardens and yards becomes more complicated. Such planting will include small trees, shrubs, vines and herbs chosen because the heights, breadths and outlines at maturity will occupy the designated position without unfairly encroaching upon lawns, gardens, passages or light openings of buildings. When one considers that such large trees as maples, elms, beech, and ash spread at maturity 40 to 80 feet, it is obvious that they should not be used freely on small lots or parks. Often a single tree shuts out all the view, and to secure outlooks without cutting it down, it becomes necessary to make framed-in openings at different heights by the careful removal of branches and twigs.

In parks or estates measured by acres instead of square feet, the control of outlook, the arrangement, for inter-communication, concourses, recreation, garden and landscape compartments, are made with similar purposes in view and with similar material as is the case in the design and construction of smaller private grounds.

In the large open areas, elevations and distances are usually on the scale that permits the use of large tree borders in place of shrubs and small tree borders, as well as the creation of larger landscape units by so disguising boundaries and buildings beyond as to give a visual ownership to a great landscape. This was done in a notable way by Olmsted from the Overlook and from Hagbourne Hill in Franklin Park, Boston.

The plant materials.

In choosing and arranging planting for all this work in landscape, the adaptability of plants to soil and climate, the hardiness, freedom from disease and insect pests, would be considered before the brilliancy or peculiarity of flowers, foliage or fruit. Horticultural varieties and forms would usually be added to enrich the detail, not to make the masses of landscape plantations. Plantations are more effective and usually less expensive if few varieties are used in large quantities, rather than many varieties in small quantities.

Persons of refined taste prefer a landscape made up of plants having the normal green foliage, with all the exquisite variations in tone, texture and shade throughout the summer season that follow the spring's outburst of delicate pinks, grays, reds and yellows in the

budding leaves. Such persons enjoy the modelling, the coloring, the bark patterns on trunks, the varied ramifications of branches and twigs in winter. They are entertained by the brief but gorgeous riot of autumn color as by a yearly Mardi Gras. For those who like to live with the garish, the spectacular and the peculiar, there are enough odd horticultural forms to make a



2077. The free center.—The Meadow, Central Park. Page 1781.

lawn landscape of curiously distorted branches and of yellow, purple and variously blotched, dissected and twisted foliage.

A very few of the finest of such forms, like the sturdy purple and the weeping beech, the vigorous Schwedler's maple, the lace-like Japanese maples, are worthy of a place in a lawn planted with the finer exotics and garden varieties, especially if the plants that carry their conspicuous colors through the summer are not allowed to compete with fine distant views or quiet lawn landscapes. Such forms may well be placed in special compartments, in which each color is massed as one masses roses in a special rose-garden. The most serviceable of these garden forms are such fastigate types as the Lombardy poplar, to make foliage screens in narrow spaces or to give such points of emphasis in green landscape as does the church-spire in the village.

There is an important place in plantations on large areas for such very rank and rapid-growing, easily propagated and therefore cheap trees as the cottonwood, willow, Russian mulberry, soft maple, catalpa, black locust, and in the warmer regions, the eucalyptus and the camphor tree. Such trees will give high, dense masses of foliage in different soils quickly. It is usual, however, to plant slower-growing, more permanent, sturdy and interesting trees, such as hard maples, oaks, magnolias, with these rapid-growing nurse trees, the latter to be gradually removed as the more permanent trees develop. In coniferous plantations, the rapid-growing and short-lived Scotch and Austrian

pine and fir balsam are not infrequently used as a filler for the more permanent and valuable pines.

In working up detailed planting plans, the knowledge that some 5,000 species and named varieties of woody plants can be purchased in American nurseries, should lead to great conservatism in planting to avoid the mussy mass of odds and ends that are scattered all over the open spaces of some small home and park grounds even now, in spite of the good advice that is being conveyed to



2076. The free and open front. Gore Place, Waltham, Mass. Page 1781.

the public in lectures, books, government and state publications.

The thorns, flowering dogwood, red-bud, wild crabs, and in the warmer sections the red bay, crape-myrtle and camellia, with a spread of 15 to 20 feet, are most suitable to give shade and make screens and borders in small lots. Such large shrubs as the weeping golden-bell, mock orange, syringa or Persian lilac have an ultimate spread of 10 to 15 feet, so they should not find place in a narrow part of the border. For small areas, such narrow, tall shrubs as the white lilac and panicle dogwood will be suitable to give high and medium high foliage. For medium high borders, such shrubs as Lemoine's syringa, Missouri currant, weigela, Van Houtte's spirea, faced with such small kinds as the dwarf deutzia, Indian currant, snowberry, Scotch rose and the dwarfier forms of the Thunberg's barberry are the safest to use.

When there is not too much lime in the soil, a broad-leaved evergreen bed can be established on the shady side of the house in which such tall varieties of rhododendrons, as *album elegans* or *album grandiflorum*, would be next to the blank house walls faced down with the lower-growing and more spreading crimson- or purple-flowered varieties, or with mountain laurel, edged with the low andromedas or dwarf rhododendrons.

The narrow strip next to a neighbor's blank wall or back yard, or between the entrance passages and the laundry or other service-yards, may be planted with such narrow tall-growing shrubs as the panicle dogwood, or such easily procured pyramidal trees as the Lombardy or Bolleana poplars, or the less common pyramidal varieties of the birch and ginkgo. If the space be very narrow, one could have a trellis covered with flat-growing vines such as the Boston ivy and the Japanese honeysuckle, which is nearly evergreen, or the Virginia creeper, which will also grow in shade. If a full evergreen cover is desired, the creeping *Euonymus radicans* is the safest vine for the North and the English ivy, or creeping fig (*Ficus pumila*), for the South, all of which will grow in shade. If broad spreading vines are permissible, then use such as the American or Japanese bittersweet, wistaria, trumpet-vine, grape and deciduous roses in the North and in the warmer section the evergreen Cherokee rose, the Macartney, Banksian and other climbing roses, the bignonias, and passion flowers.

One should determine to give the lawn plantation individuality, and distinction, but not eccentricity.

If it is desired that the gray-greens predominate, then the royal willow, the Russian olive, the sea buckthorn, the sage willow, or *Lonicera Alberti*, represent typical plants to use, ranging from middle-sized trees to very low facing-down shrubs. The mullein pink, *Alyssum saxatile*, and *Cerastium tomentosum* are herbs having a similar foliage color.

For a dark green lawn border in the North, the laurel-leaf willow, white fringe, Russian rose, bayberry and pachysandra would give a similar range of heights. In the warmer sections, such dark green plants would include the figs, laurels, guavas, and pittosporums.

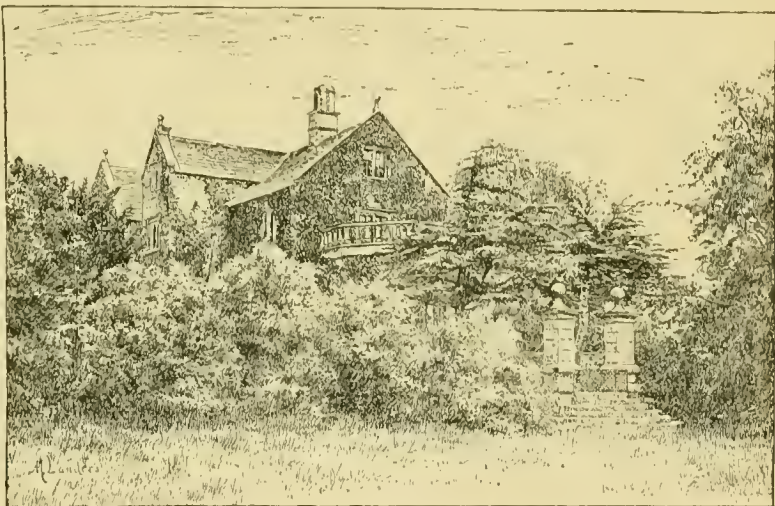
If a yellow floral display in shrubs to extend well through the season is desired in the North, one could use the Japanese varnish tree, Scotch laburnum, Cornelian cherry, golden-bell, globe-flower, witch-hazel,

Japanese barberry, and a little farther south the winter jasmine.

If a red floral display is desired in the warmest sections, the bottle-brush tree, crape-myrtle, Japanese quince, russelia, hibiscus and poinsettias are available.

There are also several families of plants such as the heath and rose families, or the Coniferae, that contain a sufficient variety in size, outline, foliage, flower and fruit completely to plant a place.

These planting suggestions relate chiefly to the older parts of the country with normal conditions of soil, cultivation and humidity. There are many sections and localities in which special soil, climatic and cultural conditions dictate the use of different types of plants and also determine the extent and character of plans for the development of places. On the southern California coast and in the arid Great Basin between the coast range and the Rocky Mountains, turf and the ordinary cultivated plants must be irrigated, and, as water is expensive and limited in quantity, only small areas can be maintained in turf and gardens at the normal cost of eastern places. To have a green land-



2078. Protection-planting.—The home of Florence Nightingale, Lea Hurst, England. Page 1781.

scape during the dry bare-ground season in these sections, advantage may be taken of evergreen orange, lemon and olive orchards cultivated for their fruit crop that come into the views. For other evergreen trees, Monterey cypress, Monterey pine, eucalyptus, pepper and camphor tree, are most easily procured. For the unirrigated land there are evergreen native shrubs like the rhus, the manzanita, the madrona, the bay and ceanothus, but as yet they are not offered by nurseries in quantities at reasonable cost. In the place of turf, inexpensive quick ground-cover plants like *Lippia repens*, various mesembryanthemums, agaves and cacti are used.

In the South, also, owing to the difficulty of establishing turf, the large lawn areas of the North are impracticable. Here about the only grass that can be relied upon for permanent sod is the Bermuda grass, which is brown in winter. Many evergreen plants can be grown here, however, under ordinary cultivation that cannot be grown out-of-doors in the northern states, such as the ivy, camellia, gardenia, Indian azaleas, Chinese privet, photinia, magnolia, hollies and aucubas.

In such northern states as Minnesota and the Dakotas, with a snowfall so light as to allow the ground to freeze deep, evergreens do not succeed and many of the deciduous plants of eastern nurseries are unreliable.

Where the ground is so deeply covered with snow through the winter as to prevent deep freezing, as about the Great Lakes, more coniferous trees and ever-green shrubs can be grown, even rhododendrons and azaleas in protected localities, unless the soil be limestone.

In poor gravel and sand some plants, such as the bearberry, crowberry and hudsonia, that will not do well in good soil, will make an attractive and permanent ground-cover, but they are not offered in quantities by nurseries. Soils that are wet much of the year support a few plants such as buttonball, red maple and willow, arbor-vitæ and tamarack in the North; in the South white cedar, cypress and palmetto. On seashores exposed to constant winds and the spray of high tides, bayberry, huckleberry, and wild roses predominate in the North, and in salt-marshes, bacecharis and iva. In the South the mangrove grows at the edge of salt-water.

The wet-land limitations may make distinctive and attractive landscapes, even though they are not so accessible, that are quite as worthy of preservation and development as the upland woods, fields and lawns.

There are usually two classes of roads and walks, the long indirect pleasure ways for occasional use that are preferably turf- or leaf-covered and the direct thoroughfares from house to town and from building to building that are in constant use and must be well drained and thoroughly constructed on easy grades.

A 5 per cent grade is regarded as the desirable maximum for horse-drawn vehicles. Curves, even sharp curves, are made through irregular steep land to gain the necessary length to give easy grades. With automobiles steeper grades are permissible, while less abrupt curves without obstruction to the view of the road are much more desirable. The tendency is to accept steeper walks with fewer steps than formerly, not alone in the cities where ramps are being substituted for steps in the great railroad stations, but also in country parks and private grounds.

Automobiles are compelling new methods of road-construction that provide either a solid surface like brick, wood block or a concrete bed with tar and fine stone surfacing; macadam or gravel bound by asphalt, tar or glutrin; or gravel with surface application of oil or calcium chloride to lay dust. Water-bound macadam

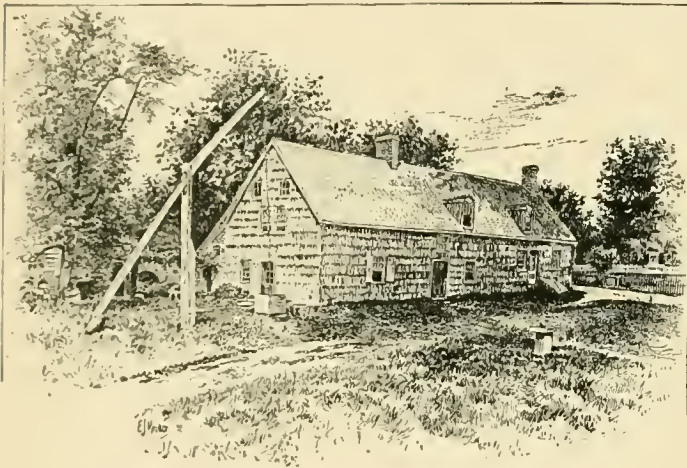
roads are out of date and a waste of money where there is much automobile traffic. When good gravel can be secured, it is likely to make the best and most economical country and private estate road if given the same attention in construction and care as was given the old macadam roads. In nearly every section of the country, good binding gravels are to be secured, such as the white cementing chert of central Georgia, the red Paducah gravel near the junction of the Ohio and Mississippi, the gray Peekskill gravel of the Hudson River, the reddish cementing gravels of eastern Wisconsin and the foothills at Santa Barbara, California, and the gravelly clays of the sandy foothill section of North Carolina of which so many hundred miles of excellent low-cost roads have been made about Pinchurst.

For little used drives and walks, well-drained turf or a covering of pine-needles or deciduous leaves are serviceable and attractive with a low maintenance-cost.

Walks can be carried down steep places attractively with a minimum disturbance of the surface and vegetation at the lowest cost by the use of stick instead of stone steps. These are made of rounded or square pieces about 2 feet long used as risers for earth or sod treads and held in place by stubs driven down in the face at each end.

Sometimes a public water system is available, or a natural gravity supply either for direct service or to operate a hydraulic ram or a water-wheel pump to force water to a reservoir. At other times windmills, gasoline, hot-air, steam or electric pumps are installed to force water from dug or driven wells, ponds or streams, to an elevated reservoir that will give gravity supply, or to air-tight tanks at lower levels from which the water is forced through the supply-pipes by air-pressure.

It is very important that sewage be disposed of in such a manner as not to contaminate the water-supply. It is very likely to do so if it flows on the surface, through the ground from the ordinary leaching cesspool; or into sink-holes as it often does in the limestone regions of the South. The danger is multiplied under such circumstances if the supply is taken from a spring or stream or well below the house-level. Even if the owner's water-supply is taken from a higher level one should consider the neighbors below in the disposal of his sewage.



2079. A type of house that needs much intimate planting. Page 1781.

There are limitations in the supply of material in nurseries that must be considered in making landscape planting plans. The plants most desired to carry out the designer's ideal may be too expensive or offered in too small quantities by the dealers. Therefore, a working knowledge must be had of the available material as well as a knowledge of the habits and cultural requirements of plants.

The grading and mechanical work.

In the development of areas for habitation and for the recreation of many persons, there must be underground pipes and surface grading. Roads and walks must be provided as well as means for supplying light and water, disposing of sewage and other wastes in a sanitary and sightly way. Grading is required about buildings and in the construction of roads, game-courts and gardens, and is often resorted to in order to secure such special effects as are indicated below: shutting out of sight a road or walk that crosses the turf foreground of a distant view or across a lawn view; making a building which stands below a road-level to appear nearer this level by having the surface slope away from the building into a valley with its opposite side at the road made more abrupt, and covered with low shrubs; making buildings on formal terraces appear nearer the ground-level by substituting for the terraces a gradual ogce or reverse curve.

There are many sewage-disposal systems now devised that will, if properly constructed and maintained, so modify the liquids as to make the outflow pure and safe. They are based on the fact that bacterial and chemical action in so-called septic tanks combined with the action of the air on thin films of liquid filtering through sand and coarse gravel over which it is discharged intermittently from syphon chambers, will destroy all dangerous organisms.

City plats and squares.

A number of men who practise as landscape architects also call themselves city-planners. Such men and others in the profession are leaders in the city-planning movement that has, within a very few years, gained such marked headway that most cities and many small towns have plans prepared for their future extension, and some states have provided for planning-boards in cities.

Such plans include a provision for public parks and parkway systems, main thoroughfares, transportation lines and terminals, and for centers about which public buildings are grouped, for playgrounds at frequent intervals throughout the city, for public squares, and such other public open spaces as the special needs of each city indicated as desirable.

The tendency is to make such plans take advantage of the irregularities of the topography and fit them more closely than do many of the early plans that require a vast amount of cut and fill to make the surface fit their lines, to provide wider and more direct main traffic thoroughfares, to omit unnecessary curves in roads and paths, and to locate public buildings and monuments at points where they will form effective street terminals without interfering with direct passage.

The accompanying sketch (Fig. 2083) of a public square and its arrangement is an indication of this tendency, for the passages across it make direct routes from street to street. The proposed structures would represent a place for effective street terminals. Provision is made for the comfort of the public in the placing of drinking-fountains and seats set back from the sidewalk line. Enough trees are provided to give shade, and a place is indicated for flower-beds where they will not interfere with the openness and breadth of the center of the square. Such squares are coming to be islands of safety and places in which to rest in the center of great thoroughfares and towering buildings. The pretty flower-gardens, curving walks and playgrounds that might be appropriate in the less crowded residential section would be quite inappropriate in a city square.

Note that these public squares should be dominated by directness and simplicity. In these crowded meeting-places there is no warrant for the fancy curves and "features" that are often made so much a part of many landscape designs. Fig. 2084, for example, shows inadmissible plans for a busy city square, with no main passages and no opportunity for somewhat secluded or recessed seats. They partake more of the character of labyrinths, and would be more in keeping in grounds where a very few persons enjoy ample leisure, or in residential parts of cities.

The general results.

There is a growing spirit of coöperation and harmony among those who are developing landscapes and gardens. A distinctively American custom is that of throwing the front lawns together on each side of a residential street in order that all who pass may enjoy the greater breadth and beauty thus gained. A constantly increasing number of persons is considering the neighbors' interests as well as their own in the location of buildings, plantations, in the cutting of trees and in other features of the planning and making of a place. There is less of that kind of architectural and

gardening originality that makes a place so out of harmony with all its neighbors as to make it an offensive vulgarity even though it may be fine in design.

For a history of landscape gardening see the introductory article. For a clear knowledge of the underlying principles that govern the profession, the reader is referred to "Charles Eliot, Landscape Architect," by his father Chas. W. Eliot; "Art Out-of-Doors," by Mrs. Schuyler Van Rensselaer; "Italian Gardens," by Chas. A. Platt.

There are many available books, American and English, in which the principles of design are referred to, but in which such practical considerations as the making and the laying out of plans, methods of construction, the description of plants and methods of cultivation are the most important parts.

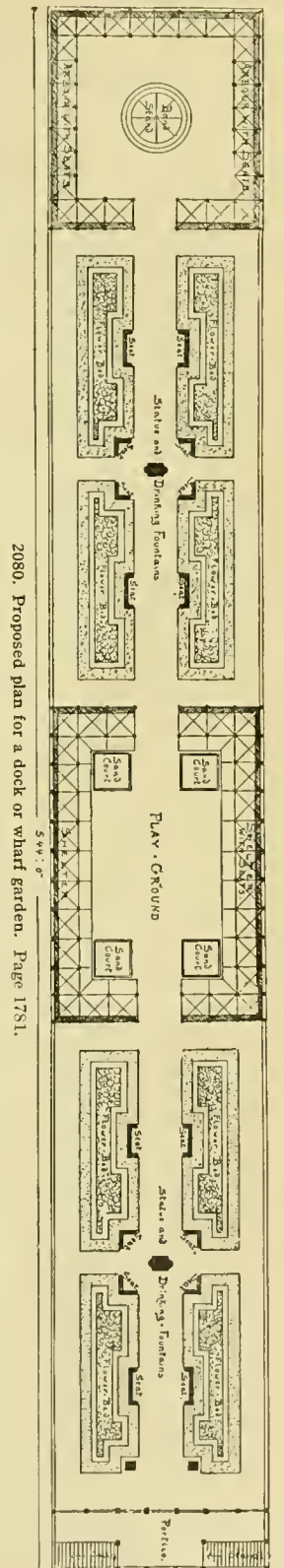
WARREN H. MANNING.

The Japanese garden.

Of a different and peculiar type, very intimate and personal, is the Japanese garden. It proceeds on different principles from the American and European garden. Examples are sometimes seen in this country, and it is well to understand the motive of them and to know what they hold in promise for us.

The garden in Japan.

It has been the theory in Japan that everyone should provide his home with all the joys and comforts associated with a garden, with the idea that it is not a general habit on the part of the housewife to secure her pleasures outside. Unlike others, the people of Japan are not contented merely with trees or flowers, but must add the rocks, streams, stone lanterns, outdoor wash-stands, wells, fences, with carp, frogs, crickets, and even bronze stalks. On the ground, one occasionally finds a private shrine, which is decorative rather than holy. A lake or pond wanders in all manner of angles, arched with projecting trees, and often dwarfed pines protect the



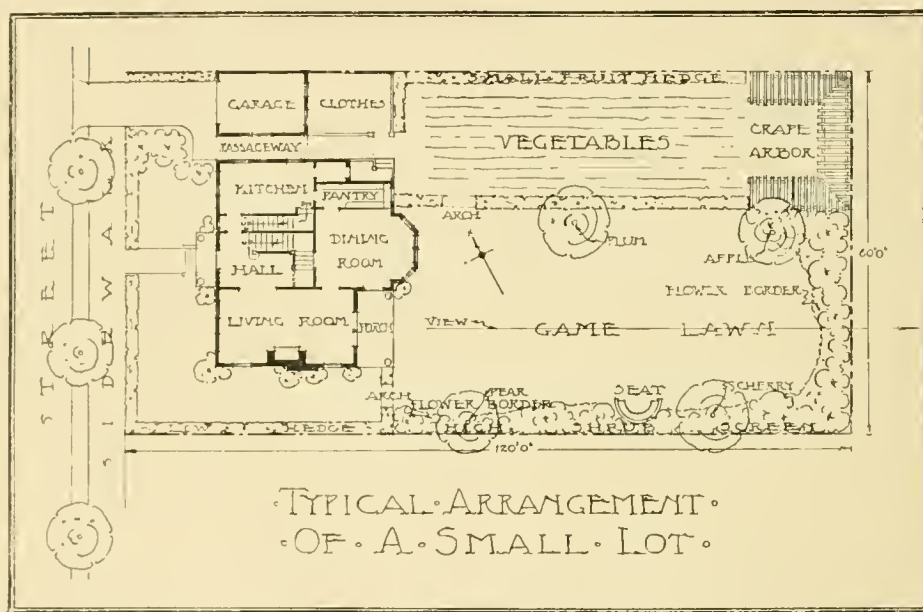
goldfishes from their enemies. It floats a boat, surrounded with duckweeds or water-nuts. On its edges, there grow iris or reeds. (Fig. 2085.)

The laws of linear-and of aerial perspective are carefully observed, no matter how large or small the garden may be. The relative stature of things, both near and distant, lightness and darkness, openness and density of foliage, the splendor or delicacy of their flowers, whether in size or in color, the season of blooming, the contour of the grounds,—all these points must be taken into account in determining where objects are to stand and how they shall be grouped. The character of the trees or shrubs controls the main part of the garden. Foreigners often feel the aspect to be rather gloomy, and to untaught eyes the best garden may be nothing but a patch of a grove.

In Japan, a greenhouse or nursery plot is never shown in the garden itself. The flowers have no recognized status or existence. They are usually hidden, and brought into sight only when in bloom. The

metropolis where the houses are thickly built. Some walks are so small that they are hopeless to set a foot in, although they may be a good imitation of some famous piece of scenery, with hills, valleys, cascades, streamlet, lakes, islets with trees; looking at the garden from the house, one may enjoy it as a sort of living picture. So, a little box of a foot square brings forth a landscape similar to a park of many acres.

There are so-called natural and formal gardens. The right choice between these two aspects of the art depends on the space, and on the features of its surroundings. While the spectator desires the innumerable delights of artistic work, he is loath to lose the hint of nature in a tiny dwarfed tree. The mountains farther back should be small and low, without trees, whereas those in the near distance must have much vegetation. The bed of the pond or river at a distance should be made high, and the nearer ones low. If one would show a pond larger, or cataract higher than in reality, one must exhibit only their parts, not an entire



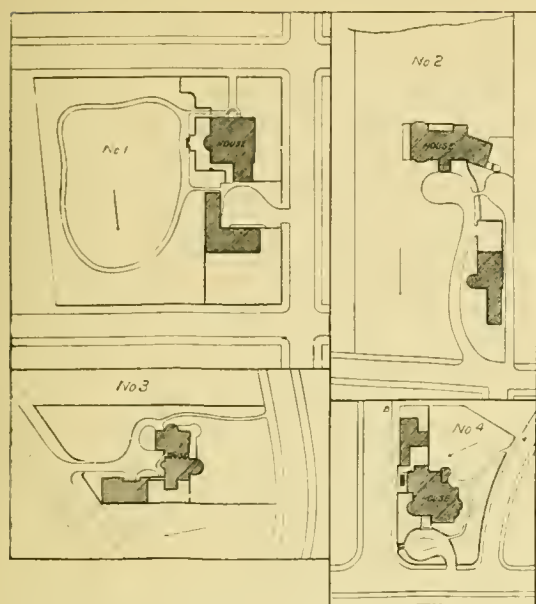
2081. Suggested arrangement of a small lot in which the desirable outdoor compartments of the grounds are properly associated with the indoor apartments of the house, and in which there is a minimum amount of road and walk surface to connect the different compartments. Each of the fruit-trees may be grafted or budded to early, medium and late varieties. The small-fruit hedges may be made of such things as gooseberries, currants and junberries, with the trimming to develop the fruit and to give also a uniform outline. The border planting is designed primarily to give seclusion and to screen objectionable views or to frame in attractive views; incidentally, it may give an abundance of attractive flowers.

roses, the lilies, the saffron, the balsams, the sunflowers, the chestnut trees, and many other things are not considered to be garden plants, whereas the bamboos, the oaks, the pines, the plums, the iris, the wistaria, the azalea, the lotus, the camellia, and others, are important. The maples are popular, but never the weeping willow. Some think it is an unlucky omen to the family that plants the crape-myrtle, grape, and other fruit trees. The different ways to place the trees or rocks indicate the degree of happiness of those who use the garden.

Yet the prime test is the proportion of the whole, and the arrangement of the walks in their prescribed order. The soil is bare or sometimes covered with mosses,—not lawns,—and it is cloven by a series of stepping-stones, leading to a little pavilion, sufficient to celebrate an old-school tea-party, or to a moon-viewing hillock, or to a place where one may secure a cool breeze on a summer evening or take a free sun-bath on a winter morning. It is a real revelation to have these privileges on one's territory, especially to those in the

pond or river. The view should be appropriate throughout the year, and the sight acceptable on any occasion, either at the time of a little gathering or of a feast; it should be untiring to the eyes of daily admirers, and should discover something new to the frequent visitor.

One man sometimes devotes half his life to a single garden, as a garden could not have been completed with a single kind of stone unsuitable to the place. Each leaf and each twig has its direction as well as proportion, regulated by the most rigid and immemorial principles. The gardeners in Japan seem to have the knack of turning the plants into almost anything they like, thereby representing beasts, fishes, and even human figures. Even a supporting post for an old leaning tree, a straw-cover to protect the shrubs from frost, and a board or fence which is a reminder of shipwreck, enter into the place as part of its attraction. Of course, the hedges or fences are not the frame of the picture, but the important part of the garden. In one of the noted public gardens in the middle west of the main island of Japan, one would see a purple precipice of enormous



2082. Suggestions for subdivision of small grounds. Page 1786.

height yonder, with a forest of several ages, and down in its front lie the shrubs, rocks, and streams, the space between the two being made indistinguishable, as if both were in one stage.

No matter what nobility owns a garden, thousands of modest cottagers are now and then permitted to peep in, and to present their opinions, and such opportunity has gradually led them to provide lovely little gardens about their dwellings at virtually no cost or no burden. It is told that this gentle art is still largely kept a close secret of craftsmen, and has scarcely been put into books. Nevertheless, the soul of the household is conveyed into every garden, to open the flowers and to grow the trees, and not merely the skill of some hired gardener. Upon the principles laid some centuries ago, the sweet flowers enlighten the harmony of the family, the vigorous shrubs give a feeling that they have grown there in the course of the years, and so they all convey to the house a quiet air of being long married or a mother of growing children. This is the real sentiment of the Japanese, who can hardly live even a day without a garden.

ISSA TANIMURA.

A classical Japanese garden (Verbeck). Fig. 2086.

The art of gardening was brought to Japan from China and Korea by the Buddhist missionaries in the sixth century. The first gardens were attached to Buddhist monasteries and generally were representations of celebrated scenes in China. Religious significance was given to their construction and the principal stones were named after Buddhist deities or their attributes.

From the Fujiwara to the Ashikaga era (seventh to thirteenth century), the evolution harmonized palace with garden, and bridges, small cottages, and conventional garden ornaments were introduced. During the thirteenth and fourteenth centuries, under the influence of the priests, Muso and Soami, of the Zen sect, the "Cha no yu" or "tea ceremony," made itself felt in the evolution of the garden which thenceforth was given a further religious character. Other great exponents of the religious "tea ceremony" were Enshin and Sen-no-Rikui; the latter designed

the gardens at Fushimi for the great Hideyoshi in the sixteenth century. Both have left many monuments in the shape of beautiful gardens now existing. The laws of gardening established by these masters form the basis of all conventions of the art of landscape gardening in Japan today. Later artists elaborated landscape gardening until in the more recent Tokugawa era the art had reached its highest refinement.

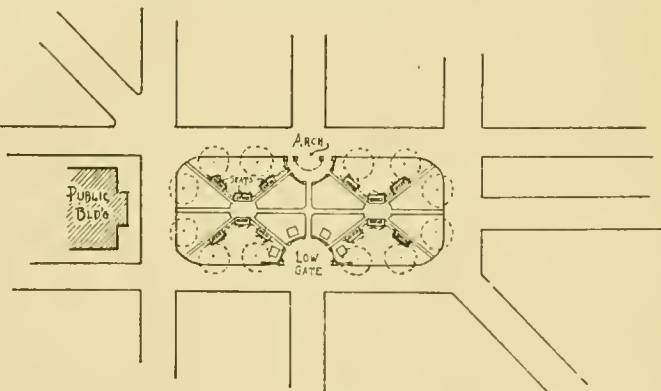
Many schools of gardening have been evolved from the classical models. There are the hill and the flat garden, those where the pond is the feature and others where the water is merely outlined and represented by dry water-courses of pebbles and sea-sand. There are the finished and highly ornate style; the intermediate or less elaborate style, following nature closely; and the free or rough style where bold and simple treatment predominates and but few of the conventional elements are introduced.

The Japanese garden is mostly green and is not of flowers. It is the scenery of a country in miniature, and gives the impression of a picture. The undulations of the hills, the outcropping of rocks and distribution of verdure closely follow nature. Hills, stones and trees have special names and have an order of rank according to shape, location, function and sacred character. Stones constitute the skeleton of the garden to which hills, vegetation and water-courses are subsidiary. Sex is attributed to stones, large, bold and rugged masses being regarded as masculine when placed in apposition to lower masses which are supposed to be feminine. Stones should be irregular and well-worn and placed as if arranged by natural forces.

In a Japanese garden there is a preponderance of evergreens for effect in winter. Of deciduous trees the plum and cherry are favored because of their breaking into leaf early in the year, and maples because of their autumnal coloring. Free use is made of azaleas, magnolias, camellias, rhododendrons, wisterias, tree peonies, daphnes, hydrangeas, and so on. Clipping and shearing of trees is much practised. Pines are bent into conventional shapes. Trees are stunted and dwarfed for use in the distance to heighten the effect of perspective. Flowering plants are placed in handsome pots adjacent to the dwelling. Iris is grouped near wells and watercourses.

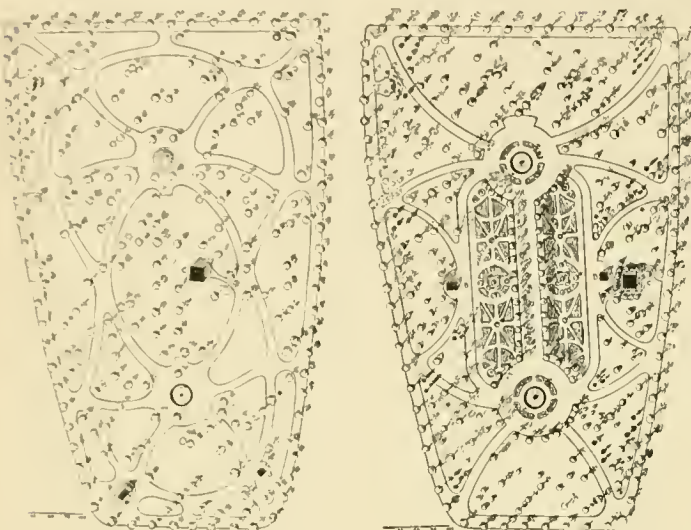
A typical garden following the classical ideals in intermediate style is here outlined.

The dwelling is so placed as to shield the garden from the malign influences of the north wind. The extreme vista must be to the south where rises hill 1, an imposing conical mound representing a distant mountain with sweeping sides. Beside it, to the left, should be its consort, hill 2, of lesser height and gentler slope. On the further slopes should appear a fringe of foliage to act at once as a frame to the picture and to harmonize it with scenery beyond the garden. Rising



2083. Plan for an open block or "square" in the busy part of a city. Page 1789.

from this group at the southern extreme should be a bold pine or oak, called Distance Tree. In the valley formed by hill 1 and 2, and shaded by a group of trees designed to produce the effect of profound solitude, flows a rivulet which terminates in a cascade. The first step of the falls which forms the cascade is high and nar-



2084. Inadmissible plans for a city square. Page 1789.

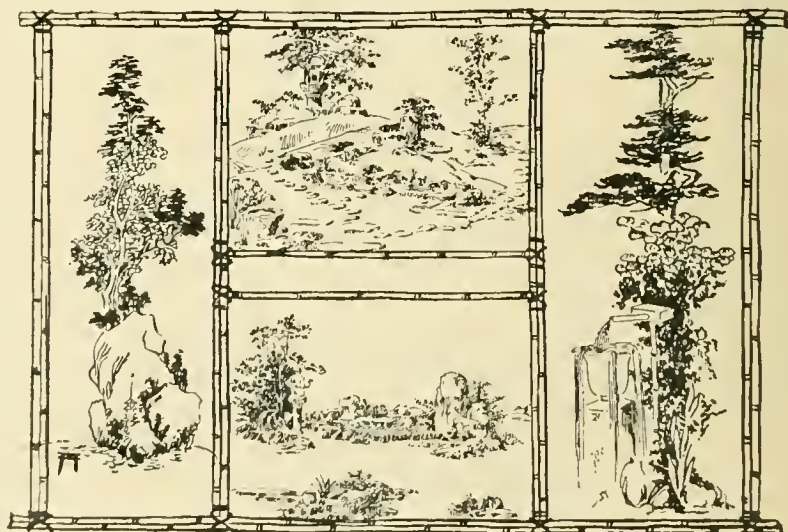
row and is arrested by "Torrent Breaking Stone" which breaks it to form the second step of the cascade which is broader but of lesser height. The upper falls represents the male, and its consort, the lower cascade, the female element. Above the falls should be an image of Fudo, the presiding Buddhist deity of the waterfall, or a representation of the image by a stone in the semblance of a statue. To the left of the cascade should be the Guardian Stone, the most prominent feature in the garden. It should be a tall sentinel-shaped stone placed so as to seem to guard the garden, and represents the male element. Paired with it on the opposite side of the cascade should be the Cliff Stone, a lower stone overhanging the water, representing the female element.

The Cascade Tree cunningly screens the waterfall to produce the effect of indefinite height. Minor trees and shrubs may be added to assist in this illusion or to conceal the water-supply. A short cataract then carries the waters to the lake which forms the central feature of the garden. Around this lake are winding walks and intersecting mounds and hillocks sloping to the water's edge, terminating in sandy beaches, and interrupted by great stone rocks or slabs and promontories, often ornamented with granite lanterns or pagodas. The contour of the lake is often an irregular triangle, the base of which is at the Principal View, adjacent to the dwelling. The other two sides taper toward the cascade which is at the apex of the triangle in the south, simulating the vanishing point in perspective. This effect of artificial distance thus created is further heightened by putting the largest trees and garden accessories in the immediate foreground and arranging others so as to decrease in size toward the distance.

The art of stunting trees grew primarily from the demand for dwarfed trees for use in producing artificial perspective and only secondarily from their use in the miniature garden. Trees of different species are grouped to contrast with each other, first, by form, and second, by color, and are placed in valleys or lower slopes of hills. The principal promontory should be bold and prominent and jut from one side of the lake so that a secondary view can be had of the garden only next in importance to the primary view at Perfect View Stone which is near the house. The distant peninsulas or promontories diminish in size. Portions of boundaries of the lake are so obliterated by shrubs and stones as to give the impression of indefinite extent, as if the visible waters were part of a large sea or chain of greater lakes. The base of the hills is covered with evergreen bushes clipped into spherical shapes interspersed with related rocks. The outlet of the lake should be in the west, to follow the law of the garden, that the water-course must follow the sun. Hill 3, which is a foothill of hill 1, is usually placed in the west. In the depression between the two should be a grove intended to suggest the location of a concealed hamlet. The principal feature in the west of the garden is Setting Sun Tree, generally a maple or other tree of red foliage, so placed as to cast the long shadows of the evening sun over the lake. Other trees are Perfection Tree,

in the intermediate distance, of moderate height but classical contour; Tree of Solitude, to give secluded aspect to a portion of the garden; Outstretching Pine, overhanging lake, and so on. Hill 4 may be placed at the east to offset hill 3. Hill 5 is a slight elevation at the base of the garden to the north, on which Perfect View Stone is generally placed, and from which point the best view of the garden picture may be had. Near it may be placed Worshipping Stone, or it may be placed on an island. Moon Shadow Stone should be in the group of trees dedicated to solitude. Other stones are Snail Stone, the largest of the stepping stones, Idle Stone, Water Tray Stone, Stone of Two Deities, and the like.

Correctly speaking, two islands should decorate the



2085. Parts in Japanese garden design.

lake. The larger one is called Master Isle and is placed in the foreground. It should be easily accessible from the bank nearest the dwelling by stepping-stones, causeway or a narrow neck of land. A tea-house usually ornaments a promontory overlooking the lake. The names of stones on the island imply functions of ease and recreation, such as, Amusement Seat Stone, or Stone of Easy Rest. The second island should be smaller and is called Guest Isle, in honor of visitors. It is located in the background and the stones on it are named Guest Honoring Stone, Stone of Obedience, Shoe Removing Stone, Water Fowl Stone, and so on.

Carefully studied effects from nature are introduced, to blend the whole into a harmonious and well-proportioned picture. Variations and adaptations from such classical models are made according to taste of the artist, or to conform to the natural features and limitations of the location.

The author is indebted for assistance in preparing this article to the work "Landscape Gardening in Japan," by Josiah Conder, who is the recognized authority on the subject, from which two of the sketches in Fig. 2085, and also Fig. 2086, are adapted.

WILLIAM VERBECK.

Formal gardens.

Historically considered, the formal garden is the gradual, natural evolution of the herb- and vegetable-garden which, since time immemorial, for household convenience was established near the country house. This garden assumed geometric form, because economical in space, easy of arrangement and distribution and obviously well adapted to the shape and proportions of the house. It was inclosed for safety; it had a central water-basin for watering convenience. Medicinal plants, small fruit trees, espalier fruit trees, and household vegetables were grown within the inclosure.

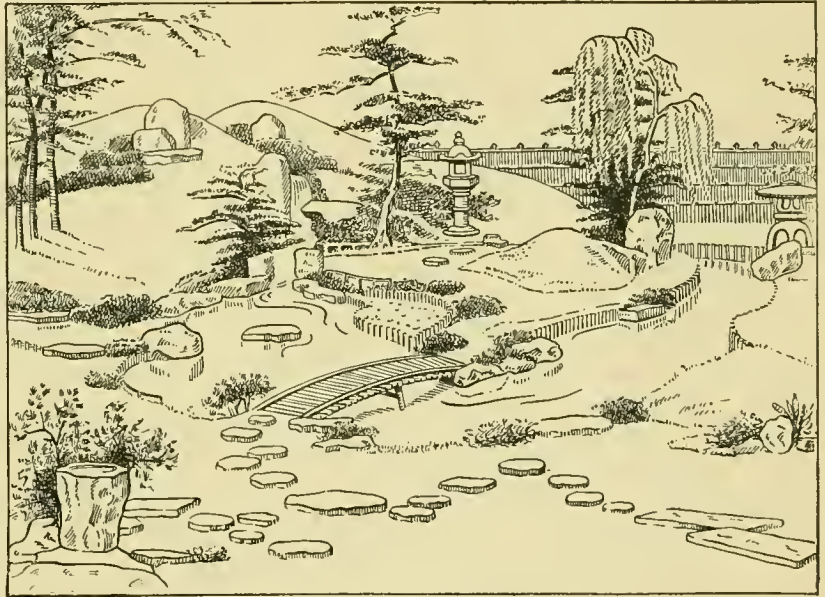
Very early, undoubtedly, in the artistic development of peoples, the beautiful aspects and possibilities of such gardens at different seasons of the year must have become apparent. Hence came a desire to improve the general effect by proper arrangement of the plants by well-balanced proportion, by ornamentation, and by cultivation and improvement of the original utilitarian plants, or by the introduction of new ones. Gradually, with a keener appreciation of beauty, persons began to separate the utilitarian part of the garden from the part devoted to pleasure and where only one inclosure catered to the physical and spiritual needs of the family, two separate units appeared: the pleasure- or flower-garden and the kitchen- and herb-garden. The geometrical form was naturally retained. The design remained symmetrical, well-balanced, harmonious. The inclosure, when of masonry, became an architectural feature adapted to the style of the house. If hedges were used, they were clipped and kept at uniform height. This cutting and trimming of the hedges invited attempts at producing, with the shears, green ornaments and fanciful shapes, and the topiary art was born. The central basin of water originally intended for purely utilitarian uses became the pool, the fountain. Trellises, small temples, statues, well-paved walks and ornaments of all kinds were gradually

introduced and the formal garden slowly produced itself.

With the development of the fine arts and the accumulation of wealth, the art of gardening prospered, and the same principles of design which governed the arrangement of the pleasure-garden were applied to the more extensive layout of the entire country place.

Congruity, utility and convenience, simplicity, harmony and balance, the fundamental principles of all landscape design, found obvious expression in the formal conception. Thus the formal naturally became the first style of gardening.

This evolution is clearly apparent in all the great periods of history: in Asia Minor, in Greece, and in the



2086. Japanese garden, with stepping-stones in the foreground.

Roman Empire. With the consolidation of the political, economic, and artistic conditions of those great civilizations, and coincident with their reaching the supreme stage of development, the art of gardening, exclusively formal, reaches its highest form of expression.

Political and military conditions in the Middle Ages shrink the villa-gardens to their original proportions of a kitchen-garden close to the walls of the castles, while the return to freedom, culture and wealth during the Renaissance restores the gardens to their former favor, nay, to a splendor never equalled before nor since. France and England imitate the Italian garden-art at first, then forge rapidly ahead to great achievements of their own.

In America, one may follow the same cycle. From the herb- and vegetable-gardens answering the same purposes and disposed in the same way as those of antiquity, the art gradually develops and reproduces on a somewhat smaller scale, and in a more intimate and simple fashion, the formal gardens of the mother countries. The colonial gardens appear in New England and in the southern states, and gradually spread all over the settlements of the Atlantic coast. Historically, therefore, as well as technically, the colonial gardens belong in the general class of formal gardens.

Technically analyzed, formal gardening, in its best forms and examples, covers a limited area in the immediate surroundings of the country house and is intimately connected with it and its outbuildings. The principal axes of the house are prolonged and maintained as the principal axes of the gardens. Some of the adaptations are shown in Figs. 2087-2091.

In size and shape the gardens maintain a definite proportion and are well adapted to the size and shape of the buildings, even more than to the general conformation of the ground. The designer depends upon his ability to mould surfaces not to do violence to the general aspects of the country and carry out his work in harmony with the architectural structures. The extreme difficulty of doing this marks more than anything else the few really successful works of the kind. The disregard of such harmonious combination, and the consequent exaggeration of the artificiality of the composition is the surest sign of the decadence of the art.

The house is usually set on an eminence commanding a good view of the country as well as the gardens. Around the house, an esplanade, or first terrace, is, more or less laboriously, architecturally treated, and is connected by stairways with a lower terrace or parterre designed as a flower-garden. In this way, a connecting

link between house and garden is secured, and the part of the grounds nearest the residence is arranged so that the eye can embrace at a glance the whole of the design and enjoy its beauty and the fascination of its color. Very often a third still lower terrace is less elaborately treated as if the intention of the designer were gradually to prepare the visitor for the end of the formal and the beginning of the picturesque surroundings of nature.

The ground plan being geometrical and symmetrical, the arrangement of vegetation is necessarily geometrical and symmetrical. Stately avenues constitute the approaches. The terraces are rectangular: special motives rectangular, circular, or elliptical. The flowerbeds generally conform with the arrangement of the footpaths; often, as in the "parterres," they are designed in patterns of elaborate nature made with dwarf edging plants and filled with great varieties of flowering herbaceous plants. All vegetation is either of such nature that size and character remain uniform throughout the year, or it is made so by the use of the shears, or by periodical transplanting.

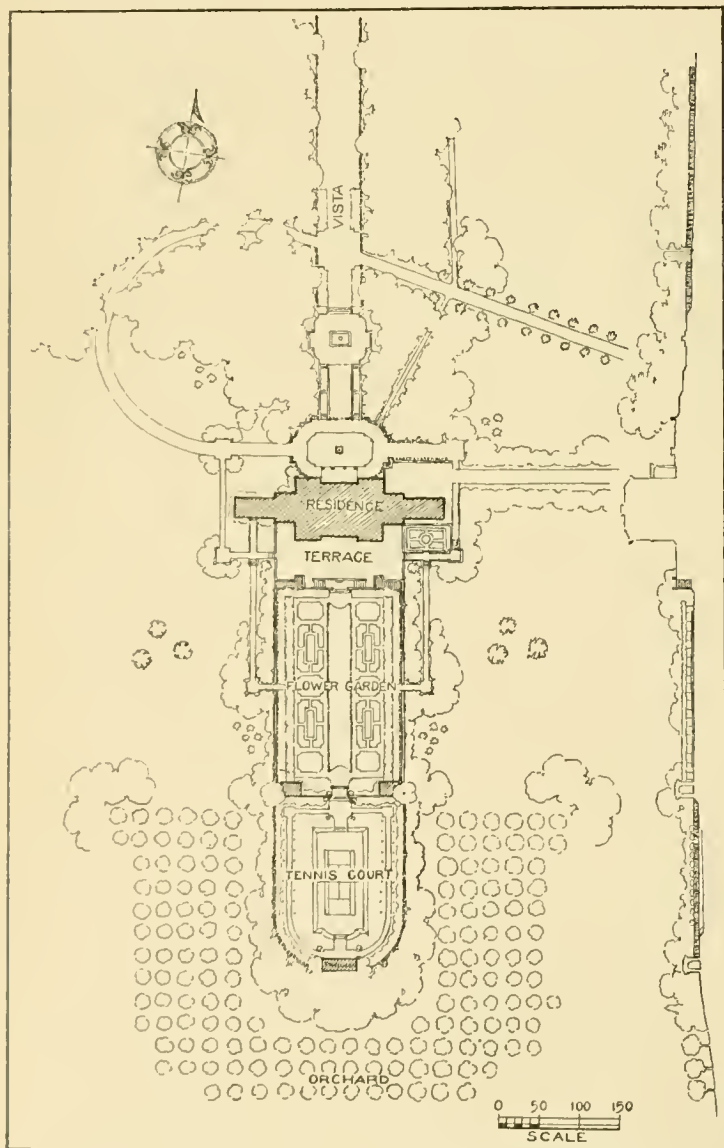
Water is usually made to play an important part in the composition. Pools, fountains, and cascades are ordinarily used as main features of design; often as secondary motives. Large surfaces of water add by their reflections to the charm of the general composition. Fountains and cascades contribute their lofty jets, and the pleasing sound of moving water to the animation of the garden.

Seclusion is essential in all formal composition. By inclosing a garden within walls, hedges, or heavy planting, a frame or setting is created which gives relief to the design, clearly defines the area of the picture and compels the eye to abstract the inclosed part from the remainder of the environment. Finally seclusion gives privacy, making the formal garden what primarily and essentially it should be: a drawing-room in the open air.

If we now consider the art of formal gardening from the botanical point of view, we are compelled for the first time to make geographic and climatic distinctions.

Although the formal gardens of Italy, of France, of England, and of America are substantially the same so far as principles of design are concerned, they vary considerably in the nature of the plants used. Possibly, it is due to this fact that in the popular mind a technical distinction is made between Italian and French or English formal gardens, while in reality there is none. So one speaks of Italian or French, or English style of gardening, while the style is independent of the country where it is used. There are formal and informal gardens in all countries and these only should properly be called styles.

A botanical analysis of the formal gardens is here out of place. Moreover, it would require considerable time and space. We may, however, sketch summarily the character of the botanical materials used, keeping in mind that species and varieties

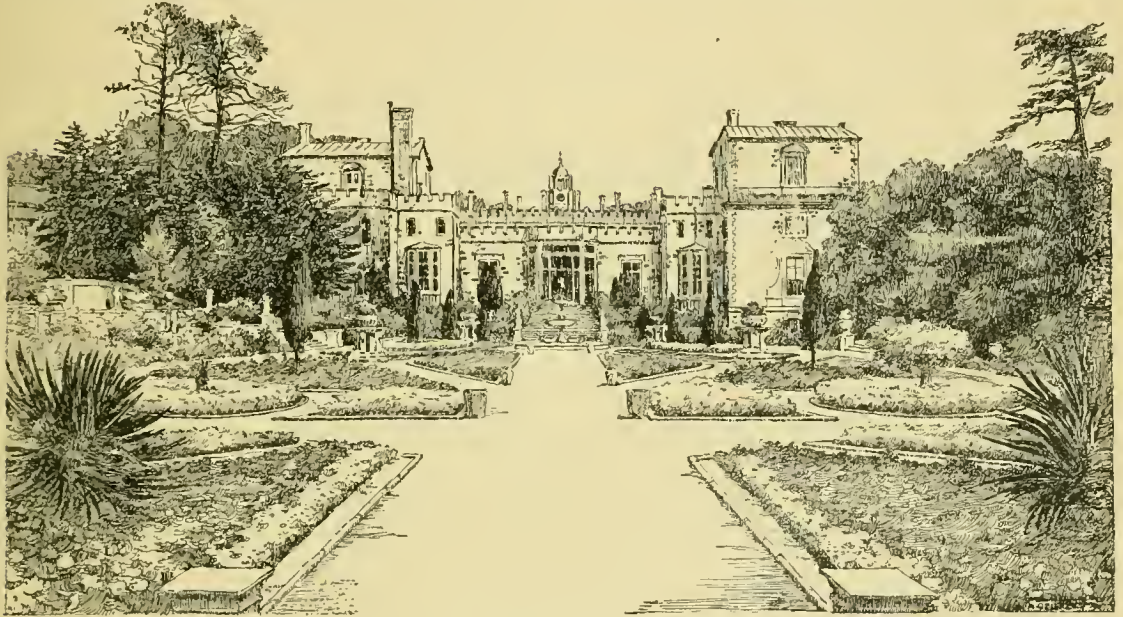


2087. Modern formal treatment of immediate surroundings of house on a large estate in America.

necessarily vary according to locality and climate and are modified by soil conditions.

Avenues are usually made with deciduous trees of symmetrical and enduring form, such as oak, linden, locust, plane, and the like. Often evergreens are used: cypress, holm oak, pine, cedar. Hedges are usually evergreen and made of material that will easily stand the shears: box, arbor-vitæ, holm oak, hemlock, holly, yew and so on. The design of the parterres is outlined by means of dwarf box edging inclosing geometrical spaces filled with low-growing annuals or perennials. Roses are also very commonly used for this purpose.

these gardens, such as lilacs, mock orange, forsythia, calycanthus, and the like, to fill the corners, to soften the architectural lines of the house or the terrace, to give privacy to the entrance or to the porch. The lady of the house took charge of the garden and special care of the perennial and the annual beds. Most of the flowers acquired sweet, attractive names, reflecting an age of delightful sentiment and real love for the out-of-doors. To give only one example, the *Viola tricolor* or English pansy was known as ladies' delight, bird's-eye, garden-gate, none-so-pretty, Kitty-come, Kit-run-about, three-faces-under-a-hood, come-and-cuddle-me,



2088. An open-center formal treatment.

Perennial and annual borders are planted against walls and hedges either in masses of single varieties or mixed in order to secure so far as possible a definite arrangement of height and color and to procure a succession of bloom.

Specimen evergreens of geometrical shape, such as conical, cylindrical, globular and spiral, are used to accentuate points of interest in the design or to establish the corners of beds in parterres, or the corners of hedges, or the axis, and so on. When the topiary art is given more freedom, the ornamental evergreens assume the shape of birds, ships, tables, and the like. Box, yew, and privet seem to be the most favorite materials for this work. Sometimes the same effects are obtained by growing ivy over a wire frame representing the object desired.

Plants in tubs or in ornamental vases, such as bay trees, lemon, or orange trees, box, century plants and oleanders, are intended, as a general rule, to supply ornamentation during the favorable season with plants which require the shelter of the greenhouse or the orangerie during the winter.

It has already been seen how in America the formal garden gradually developed by the same process that brought it into existence elsewhere. The colonial garden clearly reflected the social and economic conditions of the times in which it was produced. It was simple, well-proportioned and exceedingly well adapted to local conditions. It was small, secluded by a hedge or wall or fence covered with vines. The flower-beds were well defined by box edging; the paths were paved with brick. A good use of a few shrubs was made in

pink-of-my-Joan, kiss-me, tickle-my-fancy, kiss-me-e-re-I-rise, jump-up-and-kiss-me, and finally meet-her-in-the-entry-kiss-her-in-the-buttery, which is the longest plant name in the English language.

Since the colonial days, very much has been accomplished in the United States toward the development of the art of landscape design. The great variety of topographical conditions, of climate and soils, offered to the artist diversified problems and opportunities. The formal style has been used in moderation on the whole, and, if one disregards a few sad mistakes, with a great deal of common sense. The prevailing opinion is that its best adaptation is in the very small properties where it is evident that the house and the boundaries are too geometrical and close to allow aught else than a formal design. In the medium-sized country place when the topography is flat and several properties are close together, it is sometimes advisable, but, as a general rule, and certainly in the case of large estates, the formal style finds its best justification in the immediate surroundings of the buildings because their artificiality cannot be hidden or transformed. Here it usually answers all purposes of convenience and utility as well as it reveals harmony of composition. It is in fact the best means of gradual transition from the architectural to the rural and the picturesque.

Literature: Charles Latham, "The Gardens of Italy." Georges Biat, "L'Art des Jardins." Gressent, "Parcs et Jardins." Alice Morse Earle, "Old Time Gardens." Repton, "The Art of Landscape Gardening." Ellgood & Jekyl, "Some English Gardens." Mawson, "Art and Craft of Garden Making." Vacherot,

"Pares et Jardins." Platt, "Italian Gardens." Triggs, "Italian Gardens." Loudon, "The Villa Gardener." Ellgood, "Italian Gardens." Jane & Ross, "Florentine Villas." Hamlin and others, "European and Japanese Gardens." Kemp, "Landscape Gardening." Triggs, "Formal Gardens in England and Scotland." Edith Wharton, "Italian Villas and Their Gardens." Guy Lowell, "American Gardens." "Gardens Old and New" (Country Life Publishing Co.). Loudon, "Encyclopedia of Gardening." Fouquier, "De l'Art des Jardins." "The Century Book of Gardening" (Country Life Lib.). Andre, "l'Art des Jardins." FERRUCCIO VITALE.

The landscape treatment of small grounds.

The art of landscape gardening is to many persons a subject that belongs only to landed estates or to great public parks. By them it is not expected to serve with its principles or its practice their modest suburban or city-lot-size home grounds, although in the same way, if upon a smaller scale, they seek tasteful, practical, interesting arrangement and embellishment. The home grounds is a problem not unworthy the finest art or the most expert landscape designer. Small places everywhere are becoming more and more charming as architects meet a growing demand for better houses, and their settings become more and more appropriate and pleasing, as owners, gardeners, and nurserymen apply the achievements of landscape gardening which they have observed. Many small places evince a beauty and effectiveness surpassed by larger ones only in extent; but for the most part they fall short of their possibilities and attain to a degree of artistic value limited to the mere beauty of the plants set out. That one place can surpass another of equal building-lot proportions and comparative amount of planting would lead to the conclusion that, for the designing of small grounds, there may be underlying principles practised in some cases, neglected in others. Achievements of good design are evident; methods, seldom.

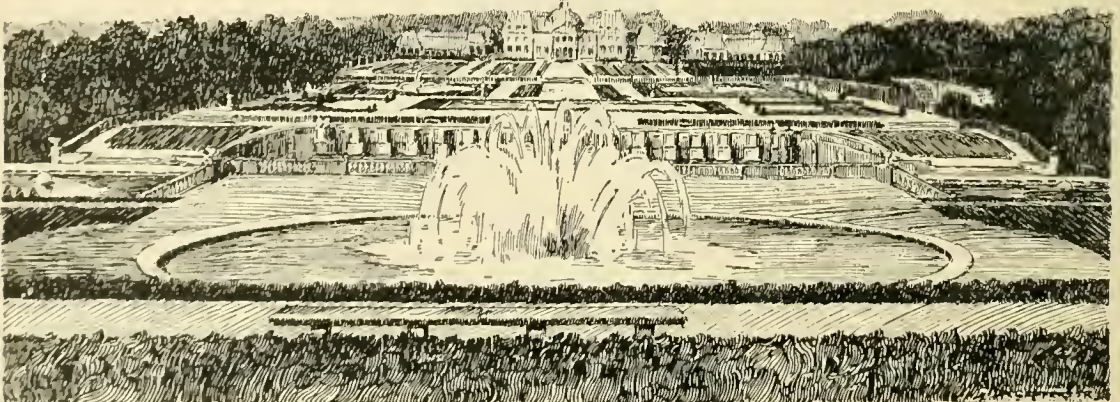
Spaciousness does not make, but may enhance, beauty in grounds; but mere space suffices to lend independence, more or less seclusion and privacy, character and dignity. Hence the small place, more than the large one, must depend for its individual effectiveness and setting upon the general beauty of its neighborhood,—its environment; upon well-placed community plantings, and upon the skilful management of a principle of design called unity,—the tying together or harmonizing of all features of the scene in view at one time. Realizing this, it should ever be the paramount aim of a community or platters of real-estate subdivisions to retain all of the natural features and landscape character possible by preserving old trees, ledges, rivulets, good views and good building-sites unmolested,

and also, so far as possible, to obliterate neighborhood eyesores. When land is laid out and houses constructed or at least restricted, by the same company, the greatest opportunity is afforded to realize the utmost of landscape and community attractiveness. To artistic grouping of buildings, to directing courses and appearance of streets, to preservation and adaptation of natural scenery for common enjoyment, should landscape gardening, as well as engineering and architecture, lend its best effort. Such development reflects directly upon very limited lot areas and affords a charm of environment impossible of attainment otherwise,—except by merest chance. Fortunate the dweller in the modern garden suburb!

Within the lot, in order to utilize to landscape advantage every inch of space, ground study should begin with house-planning and should be determined in much the same way. This saves later regret and expense and many times improves house designs as well as preserves beauty in setting. In large estates the landscape study usually precedes; in small lots, it is oftentimes the last matter thought of and generally left largely to the local grader to work out. All of our houses, as a result, become ranged in line, drilled face to the front street, commonly designed, equally spaced, uniformly graded flat, totally ignoring the hints offered in native trees or uneven ground for individual character, or of homelike seclusion possible in the back yard.

In placing houses on uneven ground, great opportunity is presented to gain distinctive character and interest or even practical advantages not offered by the more popular level site. Close to the house differences in grades may properly be shown by terracing, but it is not well that in every instance the natural beauty of uneven site be sacrificed by cutting and filling in order to create plane surfaces. In the grounds apart from the house, especially, does uneven land prove a fertile source of suggestion for landscape treatment. A low spot may become readily enough a pool; banks, rock or alpine gardens; elevations, place for planting and seat; open hollows, flower- or vegetable-gardens. How such hints may be adapted and worked together into a harmonious and livable scheme, is a landscape-gardening plan. Plans made from these hints to fit the ground are not usually so attractive on paper as those made quite regardless of site suggestions. For pure individual charm in home grounds, one likes a natural site and orderly design combined. To accomplish this is a problem.

Solutions of such problems are illustrated by the home-grounds plans here presented. Standing trees, uneven land, a large house, a lot of 125 feet frontage were the conditions met in the design of Fig. 2092. In order to preserve a large oak to spread its high head above the house roof, a retaining wall was required to hold back the



2089. A pretentious formal design. Page 1793.

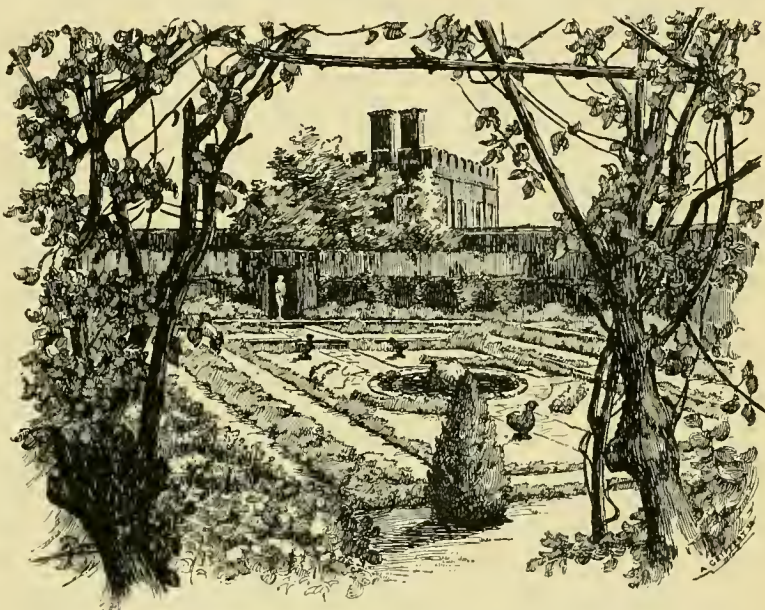
bank and roots and lawn. The house terrace and side porch nestles in beyond this, and the effect is of the terrace and porch being sunk into the ground behind the oak trunk. Add the treatment accorded the remainder of the lawn, and it becomes a very charming spot. The place is attractive because all the trees were retained at sacrifice of level lawns, planting chosen which associated itself with tree trunks and shade, and the walks are curving and inconspicuous. One of them passes behind a group of shrubs to the half-hidden garage, while a branch finds a seat built into the bank like a retaining wall under rhododendrons, and looks out upon a bit of open circular grass-plot in the sun, bordered with perennials backed by a hedge. The sun-dial rests atop a huge native boulder. Simplicity is the keynote of the plan; rhododendron and naturalized bulbs, that of the embellishment.

In Fig. 2093, all open lot, a formal garden in close relation to the house is adapted to a low portion of the lot instead of filling it up expensively. The garden is one for flowers, not architecture, and the children's play-yard under the trees is a pleasant association, in keeping.

Both of these plans, and Fig. 2094 as well, illustrate a point to be observed in planning small grounds, that house-orientation may be determined as much by the factors of site as by the usual one merely of sun. If attractive views are to be had toward the rear of the lot, advantage if possible should be taken of the fact. Such pleasant possibilities for porches and windows should not be given over undisputed to kitchen service while the family seeks the little comfort possible on the "front porch." If objectionable objects are presented to the view, they should by all means be screened off. This is accomplished usually by a thick planting of ornamental trees, shrubs and evergreens. This itself may prove so attractive as again to command a consideration of the back lot, for such screens have been known to develop into beautiful backgrounds for flower-gardening, always on view from the best windows or porch and enjoyed in perfect seclusion and privacy. A logical extension of the screen-plantings is the arranging of small trees and shrubs along the entire lot boundaries for the purpose of affording seclusion from all abutting properties, or even from the street-front. This need not be regarded as a "spite-fence" or any manner of unneighborly act; for with charming material in flower and fruit, in a beautiful form, it also lends privacy to the neighbor from his side of the foliage. Landscape gardeners would say in truth that the attainment of seclusion in home grounds is an important principle of the design. Planting is a better way than fencing.

In addition to seclusion, the second most important principle of design is served by this same screen and border shrubbery—that of adding to the space an apparent extent. The eye measures straight lines subconsciously. Seclusion alone may be attained by tall sheared hedges, rows of trees, masonry walls or vine-clad fences, but, however well executed, the effect is disappointing. A feeling of amplitude, of interest, satisfying beauty, is to be attained only through indefiniteness of boundary lines and concealment of corners; by irregularly shaped open lawn; by softness and blending of color in the foliage mass that frames it. Subtle variations in grades of the lawn uniting with studied outlines of the bounding shrubbery so that

one augments the other, afford pleasing variety and entrancing shadows; bits of lawn half concealed in the border by jutting foliage, paths or stepping-stones leading behind and through the border itself to find a hidden seat, a bit of a garden or unusual plants and naturalized flowers,—all of these devices tend to create an impression of spaciousness and to afford pleasant curiosity and constant interest. Such effects can be secured in areas 100 feet square. Green in foliage,



2090. The rear or personal garden in the formal treatment. Page 1793.

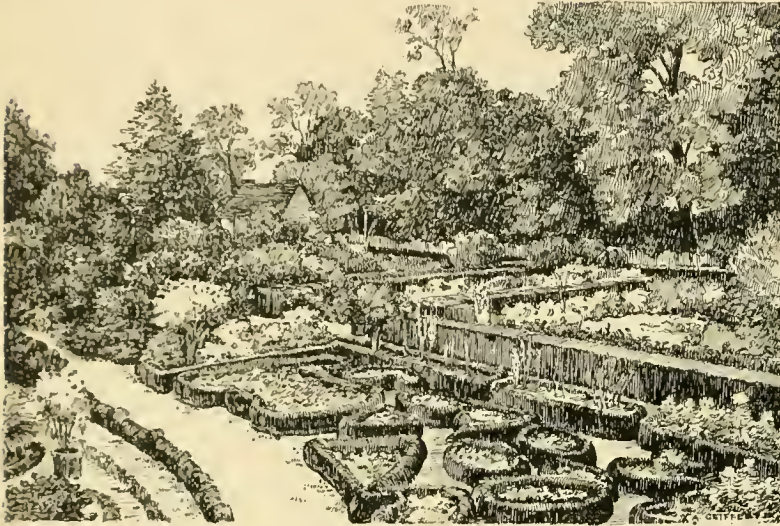
especially grayish green, lends distance; yellow and strong colors shorten it. Lawns interspersed with many individual specimens, plants and flower-beds however fine, are reduced in appearance of size. A few stragglers in group arrangement standing in the lawn near the shrubbery or in studied relations to views or little vistas are allowable. (Fig. 2093.) Planting or bedding in straight rows, whether of trees, shrubs or flowers, is likely to reduce the apparent extent. But there is reason to like straight walks when they go directly to an interesting point and do not mar the beauty of a lawn-picture which they take their traveler to examine. (Fig. 2095.)

Secluded spaciousness in small grounds should be sought, for obvious reasons. The irregular open space bounded by soft indefinite foliage massed in a curving outline of bed seems the successful means of attaining it. The materials of which this massed border is composed is a subject determined by its relation to the general plan. As the growth should be highest and thickest where views must be intercepted and lower and thinner where they may be desired, hints are afforded as to placing jutting points and receding bays in its outline. In a general way, such borders should not comprise a catalogue of nursery stock. Choose material first which by ultimate height of growth and foliage habit serves the purpose, and secondly associate with it other material valuable for bloom, fruit or foliage. Mass these in little groups or plantations of three to ten or more, the groups uniting and running together to form a happy mixture of foliage. (Fig. 2095.) In the mixtures, however, strive to find a keynote to maintain through the whole composition. This is struck by the site, the house, the personality of the owner. It may be a wooded place and woody plants like *cercis*, *cornus*, single *viburnum*, *amelanchier*, or *hemlock* and

white pine and arbor-vita, rhododendron and kalmia, ferns and little naturalized shade-loving plants, would be appropriate. (Fig. 2092.) Or it may be an open sunny place and the feeling of the fence-line or roadside wildness desired; then choose rhus, wild roses, sambucus, crataegus; or birch, wild cherry, sassafras, nut trees; red cedar, Scotch pine; wild asters, sunny asclepias and coreopsis. (Fig. 2094.) If more refined garden feeling is desired, then lilacs, syringa,

thought of having it both happily placed in the general scheme of embellishment and thrifty in growth. Position of plantations first, choice of material second, preparation of ground and care always,—this is a home-grounds program.

Gardening and architecture necessarily meet upon very close terms in suburban-lot areas. Domestic architecture needs the softening influence of foliage, the heightening effect of trees and backgrounds, land grading of an interesting and artistic as well as simply practical kind. Hints at house design should be drawn even from the natural environment and exigencies of site. Gardening requires, in small areas especially, close sympathy with the architectural style and a subservience in its design to the practical requirements of the house and owner. Its materials, structural or planting, should be appropriate to the character of the house and to the effects that logically accompany its design. Both architecture and landscape gardening in small lots should be simple and upon a scale determined by the area at disposal, not so far as design is concerned, but dependent upon the pocket-book of the owner. Richness of material is the only proper way of extravagance, not by quantity or by mere showiness. As to planting, it is to be observed that very few places are over-planted



2091. The formal flower-garden or herb-garden of colonial days. Page 1793.

weigelas and deutzias, spiraeas, snowballs, may be used with ginkgo, magnolia, Lombardy poplars, oaks and maples; hollyhocks, larkspurs, iris and peonies. (Fig. 2093.) With rustic rockwork and stony ground one should associate plant forms of the same prostrate type,—charming low matted junipers and yew; trailing wichuraiana roses and shrubby celastrus; erect cedars, cembra and mughus pines; larch, red birch, ash and hickory; and a whole list of low alpine herbaceous flowers.

Uneven sites seem to demand the cultured wildness of rhododendron foliage and flowering dogwood, an absence of close-cropped effect and a prevailing freedom and informality. This may be conditioned, however, upon the demands of the building, for there are cases in which uneven ground may be better altered; that is, when the desire is to derive the gardening lines from the building lines. Uneven ground should then become terraced and embellished with plants that are more stiff and conventional in type, more man-made to harmonize with the building. Privet and boxwood hedges, and strong colors of foliage and flowers, Irish juniper, globe-shaped arbor-vita, *Catalpa Bungei*, sciadopitys, and other plants of strong character would be appropriate.

Besides site and association, much depends upon the personality of the designer and preferences of the owner as to choice of plants. To the methodical mind, the leaning is to rare species, individual plants, botanical sequence in arrangement; to the flower enthusiast, all niceties of color harmonies and combinations in mass; to the tree-lover, generally too little room for his hobby. To the iris, rose, peony, phlox and fern enthusiasts, room and good position is given by the front edges of the shrubbery border or at sides of paths in vegetable-garden to further his ambition; and to the bird-lover, chance for pleasure in providing shrubs which bear berries for winter attraction and comfort to his friends. But whatever is planted should be chosen with the

when shrubbery is the material. Trees and evergreens more often defeat their purpose by being planted too closely.

Simplicity, then, is the third and always constant principle underlying landscape gardening in small grounds. By it is meant not elimination of interesting subjects in grades, constructions or plants, or even garden accessories, such as pools, arbors, and treillage, but fitting and unobtrusive use of them. The flowing outlines of wild copse, of modulated contour in meadow land, of unmolested trees, are simplicity ideals. In domestic gardening, such ideals should almost without exception prevail. Even if drawn down to straightened lines of formal treatment, necessary sometimes when the type of building demands architecturally treated foliage nearby, the ideal of simplicity in both design and plant material should govern the designer. Formal garden designs are oftentimes very satisfying when properly used in small areas farther from the house, reached and pivoted upon an extended house line, as straight walks from the house or terrace. (Fig. 2093.) Full of interest as regards design, beauty in detail of material, construction and accessories, and with a certain charm in its very primness set amidst ample soft flowing lines of shrubbery and trees, the small formal back yard adds a logical and an interesting feature. Sparsity of planting—not the ideal of foliage and growing things in a garden,—too much furniture, paths too wide and numerous, a lack of simplicity of both architectural and plant-forms, are reasons why formal grounds are not generally more pleasing. They are not produced successfully by mere drawing of lines, with T-square and triangle, and the amateur is safer in informal gardening. However, formality exists in each place here illustrated by house terrace and prim planting or softened wall treatments, walks, steps and walls, and even in the little geometrically arranged gardens, but dependent almost altogether upon hardy plant growth and simplicity of plan for their charm.

These gardens (Figs. 2092–2095) may be considered as informal formal gardens. The true formal architectural garden would embrace much embellishment of clipped trees, color balances and complicated design with much less emphasis upon foliage and floral effect. This in small-scale yards is generally bad practice, resulting in many failures, because it fails to lend the charm so urgently demanded in almost all problems. In the plans here shown, there is formal treatment so far as balance and instrumental lines are concerned, but the warming influence of natural growth saves the garden and makes it useful.

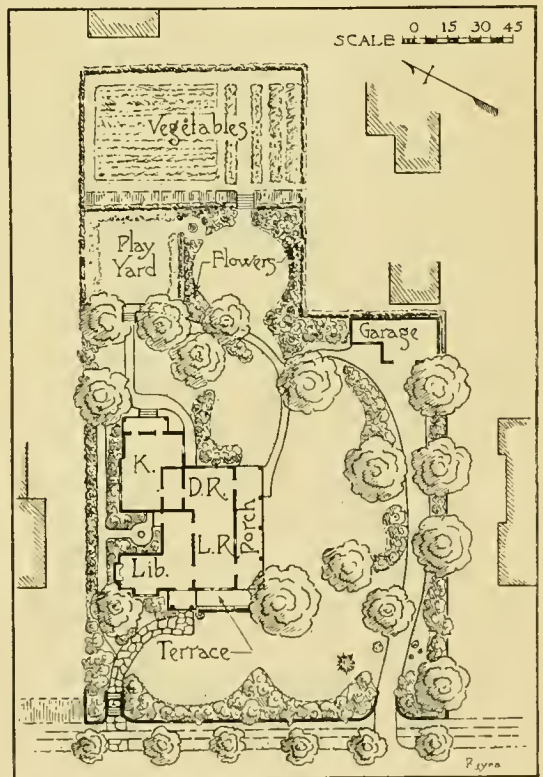
Too little thought is given by house-planners to adequate planting at base of buildings, the vital spot oftentimes of uniting house and site. The want of relief afforded by grouping of shrubbery and dwarf evergreens at this ground-line is responsible largely for that gaunt, cold, inhospitable expression many houses present. Boundaries should be planted; so also should an area immediately about the house wall. Walks and driveways should be kept at least 6 feet from the building; terraces should be arranged with planting space against the wall or outside against the terrace. The corners of buildings need especially to be supported and softened. Plants of rich and striking character are appropriate close to the house, even to sheared and tubbed plants, used to support or embellish architectural features, and close-cropped hedges of the nature of boxwood used like softened building-lines. Annual plants bedded out, or herbaceous perennials, serve the purpose in summer, but fail from their transient character. Dwarf evergreens seem felicitous by being conspicuously present in the barren season. Vines upon the wall or trellis, of course, are invaluable to relieve the blankness and do so in the least of soil-space. The softest possible wall treatment is a combination of evergreen and deciduous plants with an allowable interspersment in summer of flowering material set in front of climbing vines.

Concerning the details of developing a plan upon these premises, different designers will vary in practice. For the amateur for whom this is written, it is safe to advise at first a survey—or chain measurement of the ground locating accurately each tree, rock or native element that may stand, as well as buildings, in or adjoining the property, and views which for any reason may seem undesirable or in any way less desirable than others. These will be starting-points for a boundary planting, for the location of a garage oftentimes or even a garden to contribute to the effective screening of the view. Draw accurately on a scale of say $\frac{1}{4}$ inch to the foot a plan locating these existing conditions and with the house plan reduced to the same scale proceed to study locations for it with consideration of all that has been said above, and with “sketchy” plans similar to those shown here search for schemes that will accomplish the needs of the place and bring out its beauty. Drawing out in this way different schemes that may be possible, coupled with observation in parks and private estates, will help most in the outlining of tasteful borders and practical unobtrusive walks and driveways. These with the lawn are fundamental in home pictures; gardens, pools, arbors, rockeries, are valuable in affording greater interest and additional service of the ground.

Much of the design depends upon the way the land may be graded and, unfortunately, there are few rules to lay down. It is quite simple to level and terrace ground to a conventional formality; to grade natural-shaped slopes is far more difficult to plan and to specify on paper and depends largely upon the ability and artistic sense of the foreman and overseer of the actual earth-moving. A visualization of the regraded surface is sometimes possible by stringing white cord from point to point adjusted by tautness or sag to fit the desired levels. Drive grade-stakes into the ground to

correspond to the cord and adjust the work accordingly. The sagging cord will give the natural undercurving line so essential to simple scenery. In either formal or informal setting, the grade across the front of a building should be quite level unless it be possible to overcome the unevenness by planting heavily the lower end. It is not necessary that the front and rear corners upon the same end be graded level, but even here the appearance of unevenness is relieved by foundation planting. Steep banks should be rounded over at top and at bottom unless amounting to a frank formal terrace, in which case the top should be a sharp horizontal line. It is obvious that in any grading, the owner of a small area should save his top soil to put back on top. Grade with the subsoil to within 6 inches at the least of the desired finished surface and use only good soil in this upper layer, being careful in the operation to get no stone nearer than a foot of the surface. A caution may be sounded also with respect to grading close to standing trees, for it is important generally that roots be not injured by cutting or exposure nor trees smothered by filling against the trunks. Standing trees restrict lowering of grades but filling can be safely accomplished by “welling in” the trunks by a dry stone wall the depth of the fill.

Grade and general plan being decided upon, details of planting and constructions logically follow. When the details precede, as often is the case with amateurs,



2092. Uneven ground with old trees demands informal treatment.

unity in the place is usually lacking as a result. Fig. 2095 shows a plan developed from a sketch as suggested above, ready for the workman to carry out, for the nurseryman to supply the plants. Note the house while presenting a welcoming front door to the street, is arranged with porch and house-terrace at the rear where possibilities existed. The lawn is arranged to

become a clear bit of greensward inclosed by marginal shrubbery. In Fig. 2091, an open front lawn and secluded rear landscape garden determined the plantings. Boundaries are forgotten by the studied outlines of this shrub plantation, which, it should be noted, are in long simple sweeps, rather than little wiggly kinks so often seen. Projecting points and receding bays in this shrub mass afford interest to the lawn vistas, as well as seclusion to the back yard and pleasant course for the walks to the sun-dial, pool, and rustic arbor at entrance to the vegetable-garden at the extreme rear of the lot.

In Figs. 2092 and 2093, use is made of the side lawns for the family enjoyment. The boundary plantation is evident and in one case has been extended to a

particularly useful for the permanent plantings. Quick- and rank-growing plants may be used for screens, but provision should be made here also for permanent but slower plants to come on and replace the others. Planting quick-growing material or close planting for immediate effect is a dangerous practice, for the proper thinning is usually not accomplished and the entire planting will be robbed of beauty. It is better to space plants at reasonable distances, and use less, but of large nursery sizes.

It may be valuable to note, as to choice of plants for small areas, those which were common to the planting plans of the three places here illustrated. The list does not contain all the plants possible to use in like circumstances in the northeastern states, but will afford at least an indication of choice depending upon the restrictions of space, amateurish care, results not too far remote.

PLANTS SUITABLE FOR SMALL GROUNDS.

Those marked with an asterisk (*) are common to the three places here illustrated.

Deciduous trees.

- *Maples—*Acer campestre*, *A. saccharinum* and var. *Wieri*, *A. tataricum*, *A. ginnala*, *A. rubrum*, *A. palmatum*, in variety.
- *Shad-bush—*Anelanchier canadensis* and others.
- *Ohio buckeye—*Esculus (Pavia) glabra*.
- *Birch—*Betula alba* and *B. laciniata* of trade lists, *B. lenta*.
- Catalpa—*Catalpa bignonioides*.
- Hackberry—*Celtis*.
- *Flowering dogwood—*Cornus florida*, and var. *ruhra*. Also shrub species.
- Double-flowered cherry—*Prunus Avium fl.-pl.*
- *Red-bud—*Cercis canadensis*.
- Cercidiphyllum japonicum*.
- Yellow-wood—*Cladrastis tinctoria*.
- *Beech—*Fagus sylvatica*, and varieties, all of which require much space for growth finally.
- *Maidenhair tree—*Ginkgo biloba*.
- Varnish tree—*Koeleuteria*.
- *Larch—*Larix leptolepis*.
- Liquidambar.
- *Magnolias—the Chinese species in variety. *M. stellata* is very low.
- *Crab-apples—*Pyrus floribunda*, *Eva Rathke*, *Kaido*, etc.
- *Ironwood—*Ostrya virginica*, slow and good.
- *Sorrel tree—*Oxydendron arboreum*.
- *Poplars—*Populus nigra* var. *fastigiata*, *P. alba* var. *Bolleana*.
- *Oaks—*Quercus palustris*, *Q. coccinea*, *Q. pedunculata* var. *fastigiata*.
- Pagoda tree—*Sorhora japonica*.
- *Mountain-ash—*Sorbus americana*, *S. Aucuparia*.
- *Deciduous cypress—*Taxodium distichum*, very useful.

Evergreen trees.

- *Fir—*Abies concolor*.
- *Spruce—*Picea Engelmannii*, *P. excelsa* (for screen only), **P. orientalis*, **P. pungens*, and *P. pungens* var. *glauca*.
- *Pines—*Pinus Strobus*, *P. Laricio* var. *austriaca*, **P. Cembra* and **P. Mughas*, which are indispensable.
- *Douglas spruce—*Pseudotsuga Douglasii*, a fine screen or specimen.
- *Umbrella pine—*Sciadopitys verticillata*, dwarf and interesting.
- Henlock—*Tsuga canadensis*, nothing better under shade.

The following are really mostly trees, but used as dwarfs either for massing or standing alone. They are material which is valuable:

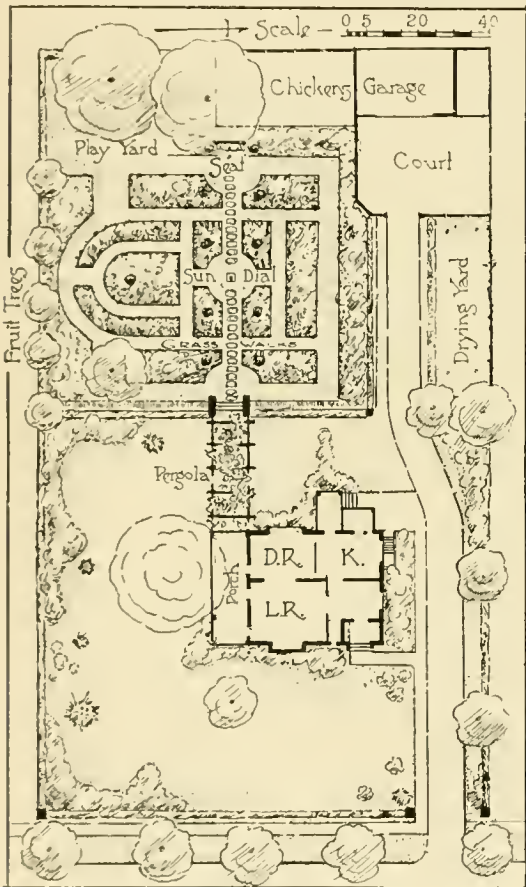
- *Japanese cypress—*Chamaecyparis*, in variety.
- *Arbor-vita—*Thuja*, in variety, according to form desired.
- *Cedar—*Juniperus*, tall and dwarf or prostrate forms.
- *Yews—*Taxus cuspidata*, *T. canadensis*.

Evergreen shrubs.

- Andromeda floribunda*.
- *Azalea (*Rhododendron*) *amœna*.
- Cotoneaster*.
- **Ilex cœnata*.
- Kalmia latifolia*.
- Leucothoe*.
- **Mahonia Aquifolium*.
- Rhododendron maximum*, **R. catawbiense*, hybrids.
- *Yucca.

Hedges, evergreen.

- **Buxus sempervirens*.
- Thuja occidentalis*, *T. orientalis* var. *pyramidalis*.
- Tsuga*.



2093. Formal garden pivoted on an extended house line.

complete border across the street front. This was made possible by the elevation of the lawn above the sidewalk and the use of a stone retaining wall which the planting relieves gracefully. This street front might have been treated more cheaply and very well by a planted bank which also affords a pleasing street appearance and a perfectly secluded lawn.

The make-up of these plantations is of simple material chosen for good foliage, hardiness, and seasonal attractiveness of flower, habit, and winter fruit or bright bark. The plants are mainly those which mix well, without clashing of bright foliage colors or incongruous forms. The consideration of size to which the plants will attain is very important and much material valuable in the large park must be eliminated from the lists for small places. Those plants which grow slowly and are in the nature of dwarf species are appropriate and

Hedges, deciduous.

- *Berberis Thunbergii.
- *Ligustrum ovalifolium, L. Regelianum.
- Rosa rugosa.
- Spiraea Thunbergii and S. Van Houttei.
- Rhamnus cathartica.
- Acanthopanax (Aralia) pentaphyllum.
- Hibiscus (Althaea) syriacus.

Shrubby borders.

- *Abelia chinensis.
- Acanthopanax (Aralia) pentaphyllum.
- *Eucalyptus parviflora, excellent in shade.
- *Althaea (Hibiscus syriacus).
- *Amygdalus (Prunus).
- *Azaleas.
- *Berberis Thunbergii, *B. vulgaris.
- *Callicarpa purpurea.
- Calycanthus floridus.
- Ceanothus americana.
- *Cephalanthus occidentalis.
- *Cercis japonica.
- Chenomeles japonica.
- *Clethra alnifolia.
- *Cornus alternifolia, *C. alba, C. mas.
- *Deutzia scabra var. crenata. *D. gracilis, *D. Lemoinei.
- *Diervilla (Weigela).
- *Elaeagnus multiflora.
- Evonymus alata, *E. atropurpurea.
- Exochorda.
- *Forsythia Fortunei, F. viridissima.
- Grasses like *Festuca glauca, *Miscanthus.
- *Hydrangea arborescens var. sterilis, H. paniculata var. grandiflora, H. quercifolia.
- *Hypericum aureum, *H. Moserianum, H. calycinum.
- Kerria japonica fl.-pl.
- *Lespedeza Sieboldii.
- Ligustrum Iboia, and var. *Regelianum.
- *Lonicera bella.
- *Lycium chinense.
- *Myrica cerifera.
- *Philadelphus, in variety.
- *Rhodotypos kerrioides.
- *Rhus canadensis.
- Robinia hispida.
- Rubus odoratus.
- *Sambucus racemosa.
- Sorbus (or Aronia) arbutifolia.
- *Spiraea, in variety.
- *Stephanandra flexuosa.
- *Symphoricarpos racemosus, S. vulgaris.
- *Syringa—the lilac in species as specimens, and in hybrids.
- Viburnum Opulus, V. Lentago, *V. tomentosum, and var. plicatum.
- Xanthorrhiza apiifolia.

Vines, self-clinging.

- *Evonymus radicans var. vegeta.
- Hedera Helix.
- Parthenocissus quinquefolia, *P. tricuspidata.

Vines, upon supports.

- *Akebia quinata.
- Campsis chinensis.
- *Celastrus.
- *Clematis in variety.
- *Lonicera Halliana.
- *Roses.
- Wistaria.

ARTHUR W. COWELL.

The landscape treatment of parks.

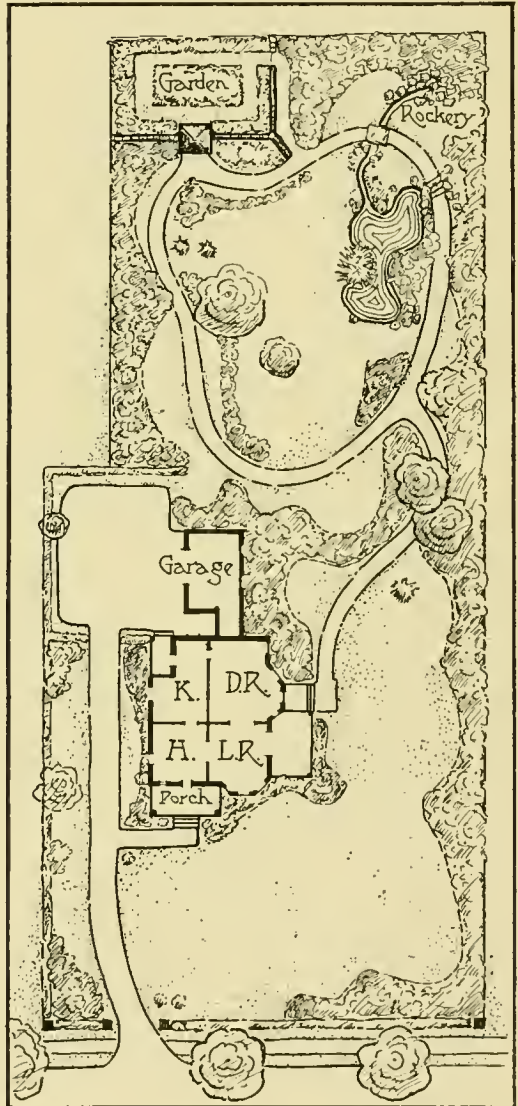
Parks are tracts of considerable size set apart primarily for enjoyment. Originally, in England, a park was a place for the preservation of deer for the chase, hence the word is often used to denote the landscape character commonly associated with such deer parks, which during the eighteenth century came to be managed much more for the sake of their landscape beauty than for deer-hunting. As a type of landscape, the deer park is characterized by comparatively broad stretches of pasture lying between irregularly and rather widely spaced masses of tree foliage. It is extremely simple and quiet in character, and while it often contains many other elements, such as ponds or running water, thickets of bushes under the trees or occasionally outstanding, or artificial structures such as drives, bridges or appropriate buildings, these features are all subordinate if the scene can be called typically park-like.

Private parks attached to country houses, in America, are usually so called because they have, or are intended

to have, something of this park-like type of scenery (Figs. 2098-2102). A place departing very widely from this type is called, according to its character, a wood or grove, a garden, a farm, or more vaguely by the general term of country-place.

Public parks.

Public parks (Figs. 2097-2102) are so called, not because their scenery is necessarily of the type properly associated with the word "park," but because the



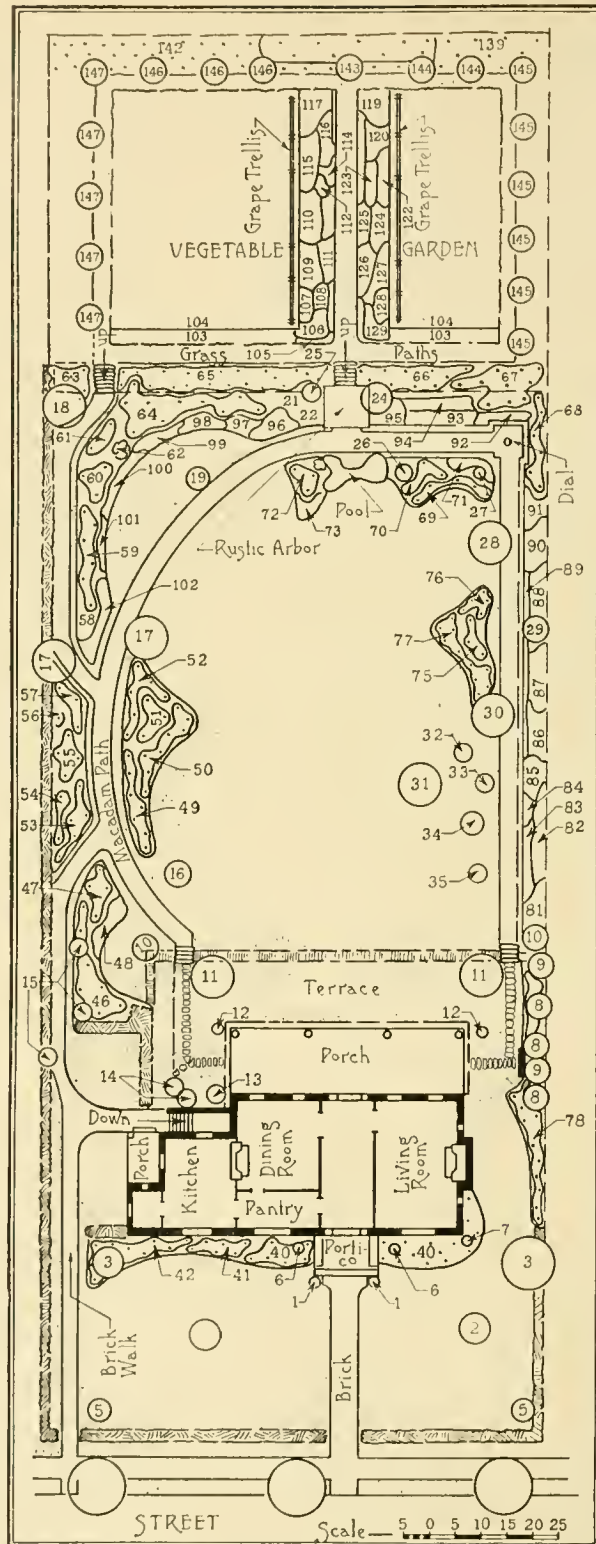
2094. Outline subdivision of a residence site. Pages 1797-1800.

Royal Parks were open to the people of English cities at the time when they began to feel the need of making municipal provision for the outdoor recreation of their growing populations. The earliest important pleasure-grounds created by cities having been modeled after these Royal Parks were themselves called parks, and the term was gradually extended to apply to almost any tract of land set apart for public enjoyment, regardless of the kind of enjoyment or the character of its scenery. But the best usage appears to confine the meaning of public park to a tract of considerable

size, leaving the lesser spaces to be called squares, gardens, playgrounds, places, and so on. Another special use of the world in America is its application to tracts of land in the West, many square miles in extent, either set apart by the government, as Yellowstone Park, or naturally distinguished by the presence of comparatively gentle grazing-land in the midst of rougher country. "Park" is also used in a more general way to indicate the general purpose of any open land devoted to public recreation, or of the organization controlling it, as "park system," "park department," and the like.

A large city park system usually contains parks of varying size and character and many smaller pleasure-grounds. No rigid classification can be made, but the following may be regarded as reasonably distinct types, each having its own field of usefulness, its own merits, and its own limitations. In practice, the lines between these types cannot be distinctly drawn, but poor results are often due to losing sight of the distinct and often conflicting motives which have given rise to these types.

1. The large rural park (Figs. 2096, 2099, 2100), generally from 200 to 1,000 acres, is in most cases the chief feature of a city park system. It is seldom undertaken except by large cities or cities so rapidly growing that the need of such provision can be clearly foreseen. Its main object is to provide conveniently in some degree for the inhabitants of large cities that sort of recreation which is to be obtained by strolling or driving in a pleasant country district. There is no doubt that the enjoyment of beautiful natural scenery is to most city dwellers one of the most refreshing antidotes for the wearing influences of crowded city life. When cities



2095. Completed plan ready for execution, developed from a sketch plan. The numbers refer to a planting-list which should accompany the plan. Pages 1797-1800.

are of moderate size and are surrounded by a beautiful country district, this enjoyment is readily accessible to the mass of the population, and it has fortunately become more so in proportion to the size of the cities within the generation embracing the transition from the nineteenth to the twentieth century, through the development of trolley car lines and the use of the bicycle and the automobile; but this increased accessibility of the country has been in part offset by the growth of the cities during the same period, and by the serious impairment of the rural quiet of the suburban regions through the same cause—improved cheap transportation. It is therefore necessary, if the people of large cities are to have easy access to refreshing rural scenery, that the municipality should withdraw from its taxable area a tract sufficiently large to provide such scenery within its own limits. The cost, both directly in money and indirectly through interference with the street system and with the normal commercial development of the land, is necessarily very great, and only the purpose of providing beautiful scenery, thoroughly contrasting with the city life and measurably sequestered from all its sights and sounds, can justify this cost, because almost all the other purposes served in public recreation grounds can be met more economically and far more conveniently in smaller areas distributed at frequent intervals throughout the city. The essential characteristics of a well-designed and well-managed park of this class are, therefore, that all of the numerous other objects which it may serve are subordinated to the provision of beautiful scenery and to rendering this scenery accessible and enjoyable by large numbers of persons, and that the

subordinate objects are met only in such ways and to such a degree as will not interfere with the simplicity and the rural and natural quality of the scenery.

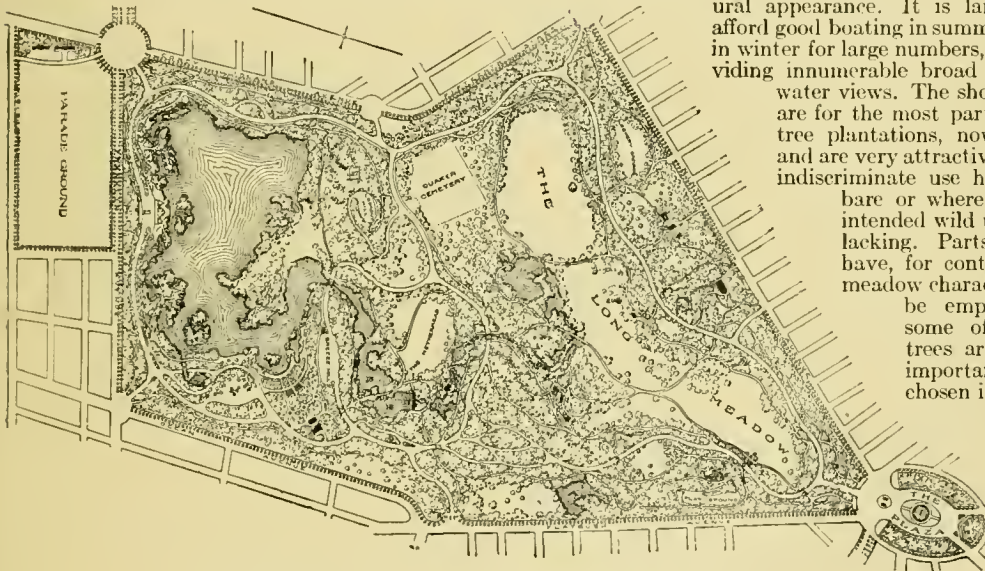
Prospect Park, in Brooklyn, begun in 1866, is here described in some detail for the purpose of affording a concrete example of the principles that the writer wishes to illustrate respecting rural parks. (Fig. 2096.) It has an area of 526½ acres. Its main entrance is about 3½ miles from New York City Hall, or 1¾ miles from Brooklyn City Hall. It is approached from the city by four lines of trolley cars, but is at the city end of the Parkway System, so that it must be reached through ordinary streets. The chief features of its design are: (1) the open, park-like landscape of the Long Meadow; (2) the woodland section, hilly and rising to an elevated outlook; (3) the lake and its surroundings; (4) a series of minor passages of scenery and elements of interest fitted in at points not appropriated for the main effects. The most characteristic and most valuable part of the park is the Long Meadow with its surrounding masses of wood, from the shade of which the outlook ranges over one of the most beautiful and simple park land-

not being shady or attractive for its purpose, has now been transformed into a rose-garden. On the lower edge of the Long Meadow are the pools which are at the source of the park ornamental water system. They illustrate both the value of water in a park landscape and the practical difficulty of securing and maintaining agreeable natural shores within the confines of a large city. Where the banks are clothed with shrubs the effect is admirable, but wherever the grass-land comes to the water's edge and in many places where shrubs once grew, the ground has become foot-worn to utter bareness. Adequate policing and prompt repair of points that cannot withstand too free use should never be lacking in all city parks. Leaving the Meadow, the water flows down through a ravine in the woodland portion of the park wholly overshadowed by trees with a varied undergrowth. Through this woodland section the paths and drives are comparatively narrow, numerous and intricate, as befits the intricacy and detail of sylvan scenery, and points of special interest are marked by simple rustic seats, shelters, outlooks, and the like.

In the southern part of the park is a lake 62 acres in extent, of artificial formation, but of natural appearance. It is large enough to afford good boating in summer and skating in winter for large numbers, as well as providing innumerable broad and beautiful water views. The shores of the lake are for the most part wooded with tree plantations, now well grown, and are very attractive except where indiscriminate use has worn them

bare or where the originally intended wild undergrowth is lacking. Parts of the shore have, for contrast, the open meadow character, which will be emphasized when some of the planted trees are cut. Several important points were chosen in the design of the park as places for the gathering of large and dense crowds, and were planned with that end in view.

The first of



2096. Plan of Prospect Park, Brooklyn, to illustrate the large rural park.

scapes in the country. But one is not brought directly to the Meadow from the outside streets. One goes at first through a formal plaza, then through a retired shady ante-chamber, just long enough to give a sense of retirement from the city, then, if on foot, through an archway under the drive that does away with the nervousness of crossing a throng of vehicles, and then one comes out suddenly upon the joyous, sunny greensward. Its extent—over 50 acres—is enough to secure an effect of breadth and enlarged freedom without bringing its whole expanse into a single view. One can see that it reaches beyond the projecting groves and scattered trees that form the background of the main composition, and he is tempted to stroll on and open up the prospects thus suggested. The surrounding groves are freely used for picnie parties, and although much of the ground is trampled bare beneath the trees, but little serious harm is done. A carrousel or merry-go-round with its loud, mechanical organ, the only discordant feature of the place, was removed to this point a few years ago. This piece of apparatus was originally located in a retired section devoted to children's games, where all sorts of amusement apparatus might be placed without intruding on the park at large. The children's playground,

these was the concert grove near the east end of the lake. The great breadth of bare ground or pavement unavoidable wherever large crowds gather frequently, makes absurd any attempt to simulate natural scenery in such a place, and in the design of the concert place a grove of formally planted trees with architectural accessories was made upon gently rising ground, arranged radially at one side of a little bay in the lake, upon an island in which the bandstand was to be placed. Upon another side of the bay a large concourse for carriages was also provided, and in connection with the formal treatment of the concert-grove was built a shelter, a restaurant and a terrace overlooking the main drive. While the grove was still so young as to be unattractive, a bandstand was erected in a natural grove near the Nethermead, a place in which the intricate woodland scenery with its brook and pools and shrubbery, and the correspondingly intricate arrangements of narrow paths and bridges, bridle-path and drive, were unfitted for accommodating a large crowd. Here the people are now drawn in thousands, on foot, on bicycles, in automobiles, and on horseback, all trampling about together, making bare earth where the grass and bushes once grew, and blocking the narrow

bridges. The unused concert place now has a display of bedding plants. The second gathering-place was at the top of Lookout Hill, which rises 100 feet above the surrounding country and commands a noble view extending out to sea. Here is a large carriage concourse, although a shelter and other provisions designed for those on foot were never built. The plantations upon the flanks of the hill have become so high and so continuous that the views are nearly closed. A third point, the Breeze Hill Concourse, which originally enjoyed a good view of the lake as well as a good breeze, is no longer attractive as a viewpoint because of the growth of surrounding trees, and has been planted with perennials, as a Colonial Garden. Of the other subordinated features of interest may be mentioned the Deer Paddock, the Wild Fowl Pond, the Vale of Cashmere, the Archery Grounds and the Greenhouses. The space set apart on the plan for a Deer Paddock is a detached open area of suitable park-like kind; this land is now used as a tree and shrub nursery, and the deer have been transferred to unsuitably steep and broken ground in the midst of the woodland section. The Wild Fowl Pond is in such a situation that there is little temptation to go down and injure its steep banks by walking along them, and the effects of the views from path, road and shelter across its surface to the picturesque foliage of its opposite margin are admirable, especially when it is enlivened by moving birds. The Vale of Cashmere is a narrow valley containing a little winding pool and filled with a rich and varied massing of rhododendrons and other flowering shrubs and evergreens, growing in an irregular and picturesque manner. However a visitor may be impressed by any of these special features, he need see none of them that he does not particularly care for, as they are all self-contained and do not obtrude themselves upon the dominant park landscape, for the sole object of securing which the limits of the park were extended to their present size.

2. *The small city park* (Fig. 2097), from 10 to 200 acres or thereabouts, is usually an effort in the same general direction as the large rural park, with a limitation fixed by the difficulty of setting apart a large body of land in one piece at a point of access to a large population. It is almost impossible to attain within so small a space the degree of seclusion from the city and the sense of breadth, simplicity and freedom that are the essential features of the landscape of a rural park; yet small passages of interesting and agreeable scenery are often attainable, and the obviously artificial objects which may intrude upon them can often be so treated as to produce a harmonious effect. The scenery can seldom be quite natural in appearance, but it can often be very beautiful, a certain elaboration, elegance and even magnificence taking the place of the more quiet and restful simplicity of a large park, in a way that appeals so obviously to many persons that there is more or less tendency to develop large parks in the same direction. It is unfortunate that it should be so, for, as these ends can be attained almost as well upon small parks as upon large, it is clearly a mistake to treat one large park in this style instead of several of smaller size so distributed as to serve conveniently a larger population. It is because more cities have small parks of this elaborate treatment than have large and simple rural parks that so many persons have a perverted conception of what constitutes a park.

Morningside Park, New York, is an example of a small city park upon an extremely rugged and picturesque site, planned, in order to enhance this quality, with an avoidance of decorative elaboration. It occupies a craggy hillside strip from 250 to 500 feet wide and $\frac{3}{4}$ mile long, with a difference of elevation from 50 to 100 feet between one side and the other, rendering the land unfit for streets or buildings. From its situation, as well as its narrow shape, it is essentially unsecluded; indeed one of its most notable features is the

impressive and utterly unrural view which it offers over the busy streets and houses that stretch away from its base. This view and the boldness of the crags is emphasized by a stone terrace along the upper edge, supporting a promenade and a tree-lined boundary street. Convenience of passage is met by numerous broad paths, with masonry steps fitted to the irregularities of the ledges. The planting among the ledges was designed to be of the wild sort such as often clothes broken ledges naturally, while the more level land at the base of the crags is treated by contrast as a smooth lawn, with scattered trees. The natural boldness of the crags is partly lost by an effort to extend turf over every possible area, and the shrub planting is possibly rather too garden-like in style to be in entire accord with the situation, but in general the park is treated in a manner approaching that of the large parks, although without any attempt at complete rural seclusion. It contains a little over 30 acres, exclusive of the boundary streets and promenades.

More commonly, small parks are used for the display of interesting and showy flowering shrubs and trees, and make a feature of fountains, statues and other sculpture more or less good. In moderation and skilfully used, such objects, are entirely appropriate and desirable in parks of this class, and add much to the effect of elegance and richness. The enjoyment is more closely related to that offered by architecture and decorative design and other pleasures forming a part of the daily city life.

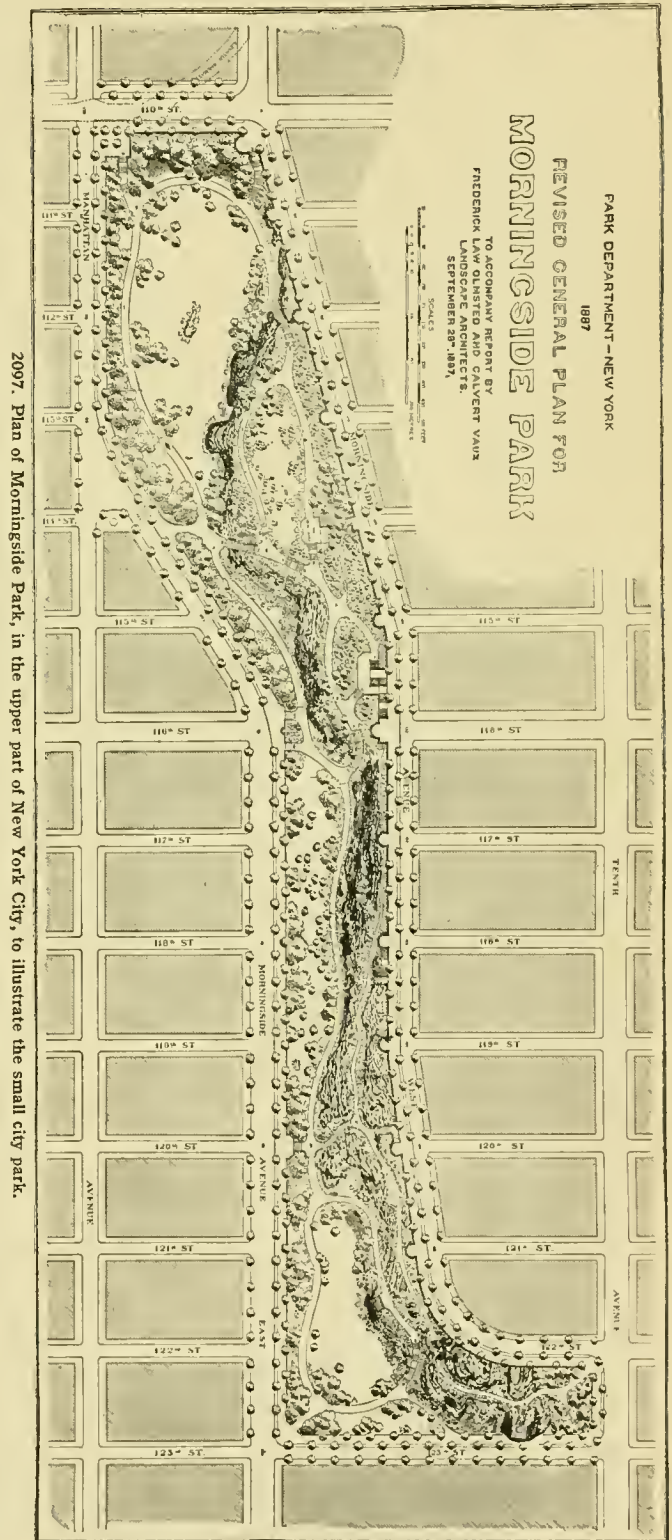
3. *Neighborhood pleasure-grounds* are spaces of varying size coming within the scope of the park system, and including numerous aims other than the enjoyment of scenery. Sometimes the leading feature is a playground for athletic sports, sometimes a sort of outdoor kindergarten for little children, sometimes a concert grove and promenade, sometimes a menagerie, sometimes a public bathing-place or bowling-place. The area is usually restricted, and, as the name indicates, the object is to offer the maximum of outdoor recreation for the people of a single neighborhood, when they have not the time to go far afield. As children out of school hours are most in need of such provision, playgrounds form an important feature in many grounds of this class; but in all the best examples the means of meeting the various practical requirements, whether athletics, band-concerts or what not, are so arranged as to produce a pleasing effect on the eye as well. This is the more difficult from the fact that these grounds get very hard usage, and it is practically impossible to maintain a respectable turf on the area devoted to a playground, which is sometimes left in loam with grass worn bare in streaks and patches by the playing, but it is better surfaced with well-compacted gravel. So far as any single example can represent this class, which must vary in every element with local conditions, "Charlesbank," in Boston, opened in 1883, may be taken as an illustration. This playground occupies a tract of about 10 acres upon the borders of the Charles River at a point near a district of considerable congestion, and occupied by a population of a poor class. A promenade was established on the edge of the sea wall about 2,000 feet in length, and between it and the street a playground was laid out, having an average width of about 250 feet. Within this long, narrow belt of public ground were established two outdoor gymnasia, each with a running-track and a building for dressing and bathing. One of these outdoor gymnasia was designed for women and children and the other for men and boys, and they are at the opposite extremities of the playground. The tract between them was laid out with walks, trees, shrubs and turf, and was intended primarily to appeal to the esthetic senses. The "Charlesbank" has well proved the practicability of maintaining, within the very heart of the city, a tract of ground occupied by greensward and trees, despite the fact that it is frequented by

thousands of men, women and children. The city of Boston provides free instruction in gymnastics upon the playground, and yearly over 70,000 women and girls, and 200,000 men and boys have made use of the facilities offered. The total cost of this playground for land and improvements was \$382,000, and the yearly cost of maintenance is \$10,000.

4. *Squares, places, gardens, and the like*, usually of small area, are scattered about a city, often at street intersections. Their principal functions are to furnish agreeable sights for those passing by them or through them in the course of their daily business, and to provide a pleasant resting-place or promenade for the much smaller number who take the time to use them so. Because of the almost constant passing through such squares, the best arrangements all provide for reasonably direct and convenient paths along the lines most used (see Fig. 2083). Otherwise, many of those who use the square are likely to be so irritated by the indirectness as to miss much of the pleasure they might otherwise receive. A formal plan of walks, either on straight lines or curved, is generally adopted for such squares, and is well suited to the conditions and to the decorative treatment of the area, providing much more effectively than an irregular plan for the statues, fountains, and gay flower-beds which have their most appropriate location in such a place. Shade trees, either as a complete grove, or in rows along the paths, or grouped in some more complex plan, are almost essential features of such squares, but where displays of flowers are to be made, open spaces must be left for sunlight. A modification of this type of square is sometimes met with where the space, instead of being used as a short-cut and for enjoyment from within, is designed primarily to present an agreeable picture to those passing it upon the adjacent streets. When the area is very small and the passing is almost wholly along one side, and in other special cases, this treatment is most effective, because, where the only aim is a beautiful pictorial effect from a limited point of view, better results can be obtained than when appearances must be reconciled with other uses of the land. Nevertheless there are few cases in which a small square will not have a greater recreative value to the public if its pictorial aspect is somewhat sacrificed to such uses as resting and promenading.

5. *Parkways and boulevards*, as parts of a park system, serve usually as pleasant means of access to parks from other parts of the city, or from one park to another, and also as agreeable promenades in themselves. Commercial traffic is usually excluded from them. Boulevards are arranged formally, usually upon straight lines, with rows of shade trees and parallel ways for those on foot and on wheels. The simplest type has a broad drive in the center with a walk on either side separated from the drive by a belt of turf and it is always shaded by trees. Frequently, two driveways are provided with a broad space between containing trees and turf, and sometimes foot-paths, bicycle-paths, bridle-paths or other conveniences, and often shrubs, flowers, statues and other decorations. A further development is arranged like the first form, with the addition of narrow streets for house frontage on each side, sometimes with a widening

and elaboration of the planting-spaces between the middle drive and the side roads. Of recent years some boulevards have been made to provide for electric-car



tracks upon a special turfed reservation with rows of trees, thus enabling the cars to be run at high speed with little danger of collision with other vehicles. Such reservations are generally between two roadways, but in some suburban districts, notably in the city of Rochester, a single track reservation is placed on either side of a single roadway, between the curb and the sidewalk. A parkway, so far as it can be discriminated from a boulevard, includes more breadth of turf or planted ground and includes, usually, narrow passages of natural scenery of varying width, giving it a somewhat park-like character and inducing a less formal treatment of the roads, paths, and accessory features. Parkways are frequently laid out along streams so as to include the natural beauties of brook or river scenery and to preserve the main surface-water channels in public control, thus providing for the adequate, economical and agreeable regulation of storm-drainage and floods.

6. *Outlying reservations* of almost undeveloped country scenery, usually from 500 to 5,000 acres in extent, are wisely included in the park systems of some of the larger cities on account of the increasing difficulty of reaching the unspoiled scenery of the open country, and because, otherwise, the increasing numbers of persons seeking such scenery upon the outskirts of the suburbs secure their pleasure at a constantly increasing discomfort to themselves and to the private landowners upon whose property they are forced to trespass. The most notable of such reservations in America are those of the Boston Metropolitan District, comprising four forest reservations with a total area of over 10,000 acres, with 33 miles of connecting parkways. The most notable of such reservations in Europe are those of London, especially Epping Forest (5,346 acres) and Richmond Park (2,358 acres); and those of Paris, amounting to about 20,000 acres, chiefly maintained, not by the city, but by the national government.

Management.—The usual and best method of managing city parks is by an unpaid commission of three or

five members appointed for terms of three or five years and retiring successively, with a view to continuity of policy and independence of local politics. Of late, a strong movement for municipal efficiency has led to placing the park department of some cities in charge of a single commissioner who is chosen for his business ability rather than for his cultivated taste. This is a great mistake. Business efficiency in park management is important but should be secondary to the main purpose of attaining and preserving landscape beauty in the large parks and the avoidance of freakishness in all the parks. The single park commissioner is dangerous because he has the power and the instinct to order the immediate execution of any personal notion or whim, whereas a board instinctively desires to discuss new projects and has to be persuaded of their merit and wisdom before it will vote for them. In creative art the best designing is personal, but in maintaining works of art a consensus of opinion is much safer. The commission appoints as executive officers a secretary and a superintendent, the latter having some technical skill, and each devoting his whole time to the work and receiving a salary. Under the orders of the superintendent, who receives his instructions direct from the board, are employed an engineer, local superintendents, gardeners, foremen, and so on. The engineer is generally an assistant of the city engineer, assigned temporarily to park work. When new parks are to be acquired or plans are to be made for their development, a professional landscape architect is employed to advise the board and to make plans, and is usually retained at least in a consulting capacity during the period of construction. Some large cities retain a consulting landscape architect permanently to advise them with regard to questions of improvement and maintenance affecting the design of the parks.

Statistics.—Reliable statistics of parks are almost unattainable. The accompanying incomplete compilation has been corrected to 1914, except a few items which are starred.

Name of city	Large parks and parkways	Acreage	Other spaces	Acreage	Total acreage	Total appropriation and cost	Population, 1910	Cost per capita	No. inhabitants per acre
Albany, N. Y.	5	283.	12	23.6	306.6	*\$2,135,700.00	102,344	\$20.86	333
Baltimore, Md.	10	2,170.56	40	130.08	2,300.64	*10,000,000.00	574,575	17.40	249
Boston, Mass., City	15	2,134.8	39	415.88	2,550.68	19,310,056.34	722,465	28.80	263
Boston, Metropolitan	14	9,427.88	14	819.92	10,247.80	19,134,462.34	1,520,470	12.58	148
Buffalo, N. Y.	7	861.76	49	367.34	1,229.10	5,000,000.00	446,889	11.19	364
Chicago, Ill.	24	3,712.76	163	1,037.86	4,750.62	*29,561,660.00	2,185,283	13.50	459
Cincinnati, O.	11	2,081.23	62	319.62	2,400.85	3,390,189.76	398,452	8.50	166
Cleveland, O.	15	1,804.907	35	120.96	1,925.86	2,276,159.58	560,663	4.05	299
Des Moines, Iowa	5	662.	16	55.26	717.26	1,163,500.00	94,238	12.35	150
Denver, Colo.	7	1,933.42	43	575.08	2,508.50	5,598,000.00	287,885	23.50	123
Duluth, Minn.	6	259.	42	117.9	376.9	*550,000.00	86,749	6.30	230
Essex County, N. J.	10	3,199.99	3	33.29	3,233.28	5,893,483.44	512,886	11.50	158
Hartford, Conn.	7	614.32	11	7.97	622.29	2,010,117.11	105,107	19.12	139
Indianapolis, Ind.	10	1,582.34	14	79.88	1,662.22	3,478,323.31	253,668	13.71	152
Kansas City, Mo.	7	1,902.06	14	93.54	1,995.60	5,853,890.93	273,943	21.37	137
Louisville, Ky.	5	1,364.9	10	114.7	1,479.6	*1,003,520.00	233,216	4.30	158
Milwaukee, Wis.	10	775.858	30	175.886	951.744	5,893,882.01	408,683	14.42	429
Minneapolis, Minn.	22	3,536.56	69	246.69	3,783.25	7,144,725.78	333,472	21.42	88
New York City	23	8,445.	129	595.	9,040.	*50,000,000.00	3,667,216	13.90	405
Borough of Brooklyn	17	1,481.85	15	91.91	1,573.76	*20,000,000.00	1,916,655	10.45	1,218
Omaha, Neb.	6	866.43	7	51.44	918.	2,066,405.54	131,093	15.80	142
Peoria, Ill.	4	395.	4	36.	431.	1,881,984.02	69,280	27.16	160
Pittsburgh, Pa.	5	1,191.	11	121.38	1,312.38	16,355,447.00	557,773	29.30	425
Philadelphia, Pa.	16	6,437.1	93	366.01	6,803.11	*6,250,000.00	1,549,008	4.	228
Richmond, Va.	*4	*354.	*9	*31.	*385.	*132,000.00	127,628	1.03	
St. Louis, Mo.	11	2,620.30	40	144.27	2,764.57	3,079,302.06	723,317	4.25	260
St. Paul, Minn.	8	996.28	50	127.21	1,123.49	2,701,580.24	231,533	11.66	206
San Francisco, Cal.	3	1,226.	30	624.	1,850	3,744,605.00	416,912	8.98	225
Springfield, Mass.	2	546.88	46	48.35	595.23	*169,000.00	88,926	1.90	149
Toledo, Ohio	7	869.	27	337.65	1,206.65	597,614.85	180,412	3.30	534
Washington, D. C.	5	2,686.91	400	1,180.36	3,867.27	*4,495,237.00	348,077	12.	93
Wilmington, Del.	5	405.62	26	66.55	472.17	*422,351.46	90,953	4.60	214

Bibliography.—"Park" in "American Cyclopaedia," "Encyclopedia Americana," Johnson's "Cyclopedia;" "Park Reports of the various cities, especially New York, 1857-1868, special report accompanying plan of Central Park, 1858; Brooklyn, 1867-1873, special report accompanying plan of Prospect Park, 1866; Boston, 1879, 1880, 1885, city document No. 125 of 1880; Boston, Metropolitan District, 1893; Buffalo, 1871, 1886, 1888; Chicago, Report on plan of South Parks, 1871; Montreal, report on Mount Royal, with plan, 1881. See "Proceedings American Social Science Association, 1870, 1880;" "Massachusetts Park Law," state printers, 1894; "Proceedings American Park and Outdoor Art Association."

F. L. OLMSTED.

Landscape cemeteries (Fig. 2103).

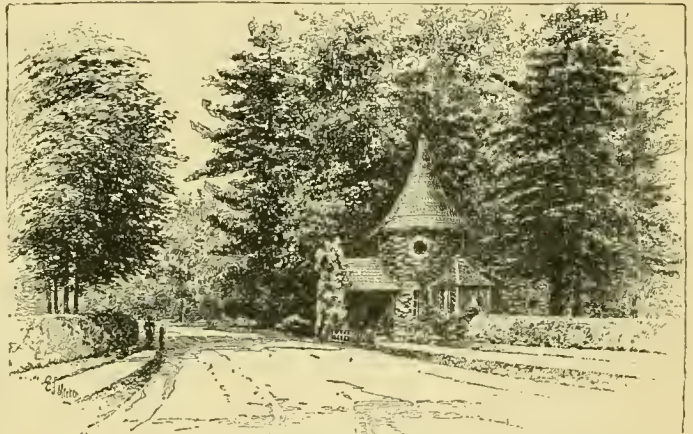
The cemeteries of the present day have come into existence from a desire to have burials made at a distance from centers of population, and among beautiful surroundings. They are often called "rural cemeteries." The first one in the United States to merit this name was Mt. Auburn, near Boston, Massachusetts, founded in 1831. Since then the idea of having burial-places park-like in their character has been spreading until they contain today some of the most beautiful landscapes developed by the hand of man. The wish to have in the cemetery the beauty of trees, shrubs, lawns and flowers has gradually led to the abolition of fences, coping and other lot enclosures, and a reduction in the number of monuments and the size of headstones. There are many who now believe that the last resting-place should be surrounded by the quietness and beauty of these features of nature's handiwork without distracting stonework or artificial objects. There are others who say that "the cemetery should be a cemetery," meaning by this expression that it should resemble somewhat closely the old conventional churchyard or graveyard, with its multitude of crowded tomb-stones inscribed with the names and good qualities of those buried within its walls.

All agree that the cemetery should be so situated and maintained as to menace in no way the healthfulness of surrounding neighborhoods. The ideal location is one where the ground is somewhat undulating and thoroughly drained by having a porous subsoil, while the surface soil is sufficiently rich and deep to support a good growth of vegetation. In some instances, as at Forest Hills, Boston, and at Woodlawn, New York, it has been necessary to blast and remove rock and then fill in the space with earth. In other cases, the natural soil has been so poor that it has been necessary to cover it with rich earth hauled from a long distance. In still other cases, it has been necessary to select a clay soil because there was no other, or to make ground by excavating lakes, using the material excavated to raise the surrounding land, or to inter above ground in structures erected for the purpose, as at New Orleans.

When a site is chosen, it is usually subdivided into sections and lots, which must be made accessible by the construction of drives and walks. A drive should pass within about 150 feet of every place available for burial. The width of the roadways should vary according to the size of the cemetery and the probable amount of driving. If the area is very small, not over 4 or 5 acres, it may be unnecessary to have any road or drive. In a little larger area, a grass drive 8 feet wide might suffice; in one still larger, a driveway 16 feet; and, finally, a cemetery designed to accommodate large populations should have good roadways 24 to 32 feet in

width. Formerly these roadways would have been made of ordinary macadam or gravel, but with the increased use of automobiles, the material used for roadways should be bitulithic concrete, bitulithic macadam, cement concrete, or brick, preference being given to the first.

Walks should generally be left in grass and form part of a continuous lawn, such walks being better in appearance and more easily maintained than those made of gravel. The location of the drives will determine the shapes and sizes of the sections. The plans should be made after a careful study of the ground in question, the drives being placed so that they will have easy grades, command good views, and be as few as possible while being approximately 300 feet apart. When the ground is irregular in shape, or has steep slopes, or contains streams or lakes or valuable trees, these features may make it necessary to construct more drives than would otherwise be needed. They can generally be staked out on the ground by eye with a better effect than if drawn first in an office by the use of some



2098. Entrance to an American residence park. Page 1801.

geometrical curve. They should nearly always be curved to produce the most pleasing result, a curved driveway being advisable because: (1) when the margins are properly planted certain portions of the ground are always hidden; thus becoming more interesting; (2) they insure varied effects of light and shade; (3) they make the average distance from the cemetery entrance to the lots shorter than if one follows straight lines and turns right angles.

An open tract, to begin with, is in many ways preferable to one that is thickly wooded, but groups of trees or single specimens that have broadened out in a natural way would be very valuable, since they would help to take away the naked, forbidding appearance of land newly planted with young trees. On a vacant area, it is usually advisable to plant some large trees for the sake of immediate effect. These can be grouped about the entrance, a fork in the drives, the top of a hill, the margin of a lake, or other distinguishing position. The objection to a piece of land covered with thick woods is that the necessary thinning to get sufficient open space will leave tall, spindling trees, unused to exposure. These are not very attractive in themselves, are very likely to die and are liable to be blown down. If there are thick woods in the land chosen, the trees chosen to remain should be those that are healthiest and have the lowest branches. Some of the trees removed might be cut off at the ground, when the sprouts springing from the stump will form beautiful bush-like specimens.

The necessary buildings will vary with the size of the

cemetery, but they should always be modest in appearance and suitably embellished with shrubbery and vines. The office would naturally be placed near the entrance to avoid unnecessary walking, but it should not be built immediately on the highway or public street. The large arch frequently built over the gateway is



2099. Vista in a large rural park. Page 1801.

usually too pretentious in appearance and not in keeping with the character of the grounds. A natural archway of living trees would be better. The chapel, if any, should be placed some distance within the grounds to give it greater seclusion and quietness.

Whether there should be greenhouses or not cannot be discussed here on account of the limits of this article. It may simply be said that with the great variety of flowering trees and shrubs which we have to choose from, as well as the thousands of hardy flowering herbaceous plants, most beautiful effects can be produced without the expense, the continual labor and the bare beds more than half the year, which would follow the construction of greenhouses and the use of bedding plants. Usually the selection for planting of material found growing in the adjacent country will help produce satisfactory results with little expenditure of money and time. To prevent intrusion, a fence along the boundary of the cemetery is necessary, but this can be a simple inexpensive wire fence, serving in places as a support for vines, and in places being hidden by a belt of trees and shrubbery. No one would now make the cemetery dreary by confining the planting to spruces and weeping willows. On the contrary, every effort is made to secure bright cheerful effects by the selection of all kinds of flowering happy-looking plants. The modern cemetery becomes, in fact, a sort of arboretum. It includes some evergreens which are most suitably grouped along the boundary belt, and which should contain all kinds of hardy pines, as well as some of the more stiff and formal spruces. The planting of Norway spruces has in many places been overdone. The development of attractive landscapes in cemeteries is of so much importance that Mr. Strauch, the greatest cemetery designer that we have had, used to call the present method "the landscape lawn plan."

A good landscape in the cemetery is usually the result of years of growth. It must first be intelligently designed, and then receive care and attention from

someone familiar and in sympathy with the scheme adopted. To insure such attention, and to protect the interest of all lot-owners, as well as to maintain the dignity and character of a city of the dead, rules have been adopted by all leading cemeteries. These rules are the result of study and experience on the part of many men. At a meeting of the Association of American Cemetery Superintendents, held at Boston, in 1890, the following rules were recommended by a unanimous vote of those in attendance:

Rule 1. (This should be a general rule, stating the authority and conditions on which lots are sold and the restrictions on transfers. The rule, of course, would have to be varied according to conditions existing in each cemetery.)

Rule 2. The trustees desire to leave the improvement of lots, as far as possible, to the taste of the owners; but, in justice to all, they reserve the right, given them by law, to exclude or remove from any lot any headstone, monument or other structure, tree, plant, or other object whatever which may conflict with the regulations, or which they shall consider injurious to the general appearance of the grounds; but no trees growing within any lot shall be removed or trimmed without the consent of the trustees.

Rule 3. Lot-owners may have planting or other work done on their lots at their expense, upon application to the superintendent. No workmen other than employees of the cemetery will be admitted to the cemetery except for the purpose of setting stonework.

Rule 4. No iron- or wirework and no seats or vases will be allowed on lots, excepting by permission of the trustees, and when any article made of iron begins to rust the same shall be removed from the cemetery.

Rule 5. The trustees desire to encourage the planting of trees and shrubbery, but, in order to protect the rights of all and to secure the best general results, they require that such planting shall be done only in accordance with the directions of the superintendent of the cemetery.

Rule 6. No coping nor any kind of inclosure will be permitted. The boundaries of lots will be marked by corner-stones, which will be set by the cemetery, at the expense of the lot-owner, with the centers upon the lines bounding the lot. Corner-stones must not project above the ground and must not be altered nor removed.

Rule 7. No lots shall be filled above the established grade.

Rule 8. All interments in lots shall be restricted to the members of the family or relations of the lot-owner.

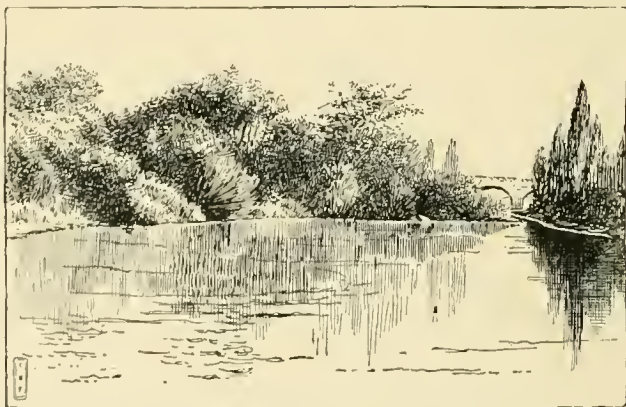
Rule 9. No disinterment will be allowed without the permission of the trustees, of the lot-owner, and of the next of kin of the deceased.

Rule 10. Mounds over graves should be kept low, not exceeding four inches in height; and stone or other

enclosures around graves will not be allowed.

Rule 11. Foundations for all monuments, headstones, and the like, shall be built by the cemetery at the expense of the lot-owner and fifteen days' notice must be given for the building of foundations. The cost of the same must be paid in advance.

Rule 12. Every foundation must be at least as wide and as long as the base stone resting upon it, and must



2100. Water scene in a large rural park. Page 1801.

not project above the surface of the ground. All foundations must extend as low as the bottom of the grave.

Rule 13. Only one monument will be permitted on a family burial-lot.

Rule 14. (This should be a rule limiting the height of the headstones, and the lower this limit is made the better. Even with the lawn is considered best.)

Rule 15. All stone and marble works, monuments and headstones, must be accepted by the superintendent as being in conformity with the foregoing rules before being taken into the cemetery.

Rule 16. No monument, headstone or coping, and no portion of any vault above ground shall be constructed of other material than cut stone or real bronze. No artificial material will be permitted.

Rule 17. The trustees wish, as far as possible, to discourage the building of vaults, believing, with the best landscape gardeners of the day, that they are generally injurious to the appearance of the grounds, and, unless constructed with great care, are apt to leak and are liable to rapid decay, and in course of time to become unsightly ruins. Therefore no vaults will be permitted to be built unless the designs for the same are exceptionally good, and the construction is solid and thorough. The designs must be submitted to the trustees, and will not be approved unless the structure would, in their judgment, be an architectural ornament to the cemetery.

Rule 18. Material for stone or marble work will not be allowed to remain in the cemetery longer than shall be strictly necessary, and refuse or unused material

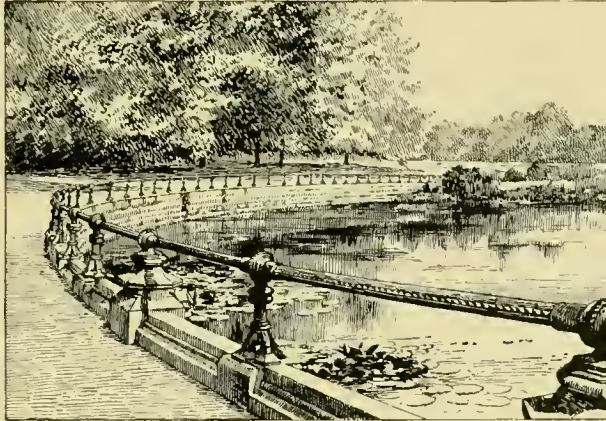
must be removed as soon as the work is completed. In case of neglect, such removal will be made by the cemetery at the expense of the lot-owner and contractor, who shall be severally responsible. No material of any kind will be received at the cemetery after 12 o'clock m. on Saturdays.

Rule 19. The trustees shall have the right to make exceptions from the foregoing rules in favor of designs which they consider exceptionally artistic and ornamental, and such exceptions shall not be construed as a rescission of any rule.

Rule 20. It shall be the duty and right of the trustees from time to time to lay out and alter such avenues and walks, and to make such rules and regulations for the government of the grounds as they may deem requisite and proper and calculated to secure and promote the general object of the cemetery.

Rule 21. The superintendent is directed to enforce the above regulations and to exclude from the cemetery any person willfully violating the same.

Cemeteries should be established upon a basis to enable those in authority to take uniform care of the grounds for all time. The prices charged for lots should be high enough to enable a fund to be set aside that will yield an annual income sufficient to pay all necessary general expenses. In laying out a new cemetery, those in charge should seek the best advice available. Such advice should be based on a thorough knowledge of landscape gardening and the special needs of burial-grounds. Much information can be obtained by visiting Spring Grove, at Cincinnati, Ohio, generally recognized as the pioneer of park-like cemeteries, and perhaps the



2101. Edge of the concert grove in Prospect Park.



2102. A park-like effect in a private place.

beautiful park, a real picture, we might call it, for a sleeping-place, it seems strange to put into this picture obelisk after obelisk, stone posts and slabs of all shapes and sizes, and stone tombs within whose walls their owners hope to have their dead bodies preserved forever. The history of sepulture shows the futility of trying to preserve one's body or one's name with the help of stone. A man can hand his name down to posterity only by his own work, and even if his body should be preserved as long as were those of the ancient Egyptians, it might finally be used only for fuel. These facts should be recognized in the modern cemetery. The ground should assist in changing the body back into inorganic forms or to receive the ashes, if the quicker process of cremation is adopted. The scenery should solace those that are bereft.

It is repugnant to our best feelings to use the same land over and over again, as is done in many cities in Europe and, to some extent, in the United States. A cemetery is frequently spoken of as the last resting-place, and it serves mankind best when it is so in fact, since in that case, after it has served its purpose of purification, it becomes a park, a breathing-place for the people of the city, whose growth is likely to crowd the vicinity with houses. The memory of past generations will certainly be sweeter if it is associated with trees than if it is connected with tombs, catacombs and pyramids. The problem presented to cemetery associations is, therefore, how to secure the most pleasing combinations of growing plants, including trees, shrubs, flowers and grass; the most satisfactory views; the most harmonious and restful park, for the cemetery is really a memorial park.

Those seeking information on this subject will find it in the reports and histories of the various cemeteries and in encyclopedias. The development of the landscape idea in connection with cemeteries is given in some of the reports of those institutions, that of Spring Grove, for the year 1869 being especially valuable. The reports of the Association of American Superintendents contain many papers of interest. The volumes of the "Modern Cemetery," afterward the "Park and Cemetery," the leading periodical devoted to the interests of burial-places, contain articles relating to all phases of the subject. All books relating in any way to landscape gardening are of value in cemetery work, since they treat of all its natural features.

O. C. SIMONDS.

Horticultural phases of civic art.

It is the plan of this work to discuss horticultural phases of landscape gardening without entering upon questions of design. It must be said, however, that problems of structural design and orderly arrangement are much more fundamental and important to all phases of civic art than the mere ornamental horticultural treatment. This statement having been distinctly understood, we may proceed to discuss the horticultural phases of this subject which are indeed extensive and important.

Civic art may be somewhat accurately defined as the conservation, improvement, and utilization of public property. With negligible exceptions, civic improvement deals exclusively with public property or with property owned by quasi-public corporations; or, at farthest, with private property administered in the public interest.

The forms of public property in most common use are roads, town commons, parks, "squares," playgrounds, school grounds, church grounds, cemeteries, railroad station grounds, historic and scenic reservations, and forest reservations. Some horticultural treatment is requisite for the development of practically every one of these several types of public property. This means chiefly the use of trees, shrubs and grass.

Streets.

In all except the crowded business streets in mercantile and manufacturing sections of cities, street trees are considered desirable. Indeed some of the finest and most important business streets in the world are beautifully parked with trees and shrubbery; e. g., Unter den Linden, Berlin; and the Ringstrasse, Vienna.

The usual method of treatment is to plant a double row of trees, one on either side of the street, carefully aligned with the street and regularly spaced. These trees in any certain section should be all of one species and of one age. As a rule these trees will be placed between the curbing and the sidewalk, though other arrangements are made in special cases. Wide boulevards and pretentious residence streets are sometimes planted with four rows of trees. In this case it is generally desirable for all of the trees to be of the same kind and age, though good effects are occasionally produced by having the two intermediate rows of an entirely different and contrasting species. Occasionally a narrow parking in the middle of a wide street may be planted with a single row of contrasting ornamental trees such as palms, magnolias, hawthorns or apples.

In many narrow streets it is desirable to plant a single row of trees which would usually be of some small-growing and very hardy species such as horse-chestnut or ailanthus. This single row should be placed just inside the gutter line on the north side of streets running east and west and on the east side of streets running north and south. (For species of trees suited to different sections, see Waugh's "Rural Improvement.")

In addition to trees, most streets need a strip of grass. Indeed the trees will not thrive unless there is some open planting strip where the soil is exposed, and this planting strip should practically always be kept in grass. These grass spaces should be of regular patterns—that is, they should not be cut to pieces by intersecting paths and roads—they should be evenly graded and should be kept well cut and trimmed.

In streets or boulevards where elaborate parkings are maintained, the horticultural embellishments may reach to almost any extent. A common treatment in continental Europe, but one hardly known in America, is the use of festoons of ampelopsis or clematis. In America, street parkings are commonly made up of shrubbery masses, sometimes interspersed with groups of hardy herbaceous material or even with cannas and other hothouse plants. The present custom is to arrange these parkings with marked informality. It may fairly be suggested that the character of street development would make a more formal treatment more effective.

Such shrubbery parkings should be confined to the most hardy and resistant species, such as spireas, barberries, the best viburnums, privets, and the like.

It hardly needs to be remarked that such parkings are expensive. They should not be undertaken except in circumstances where liberal treatment can be given. The initial cost of development, for parking alone, should run from \$5,000 to \$10,000 a mile; and the average annual up-keep from \$2,000 to \$3,000 a mile.

Country roads.

Tree-plantings along country roads are quite as desirable as along city streets, although the problem here is decidedly different. Some species of trees, particularly large-growing conifers, can be used on country roads which are not available for city planting. Some objection has been made at times to tree-planting for country roads on the ground that it prevents the road-bed from drying out, especially in springtime. This objection is somewhat captious and is not generally accepted. While it would seem undesirable to have all country roads everywhere planted with trees, it may safely be said that permanent plantings should be much more extensive than they now are.

In this connection it seems proper to notice a scheme which is frequently urged in this country, viz., the planting of country-roads with fruit trees. One prime argument always advanced by the advocates of this plan is its successful use in Europe. Extended observation in all the countries of continental Europe convinces the writer that fruit trees along country roads are rather rare. Especially uncommon are examples of extensive municipal planting and maintenance of such fruit trees. At the same time Europe has certain definite advantages over America in enterprises of this kind. On the whole the plan seems generally impracticable in America. The exceptions to be noted are rows of apple trees rather frequently seen alongside of farm fields in New York state and New England. These are indeed very beautiful and a great addition to the public pleasure in the use of the roads. They are always held as private property.

Scenic roads.

Besides the planting of simple rows of trees along country roads, much more extended developments will be highly justified in many cases. First of all, the shrubby borders along the roadside may be conserved and improved. Where such natural shrubby borders do not exist, they may be planted and such plantings should be designed and carried out by expert landscape gardeners, seeing the work is of such general value. Numerous promising experiments have been made in the last few years in this direction of developing attractive roadside plantings.

Such public roadside plantings may properly become the conservation grounds of native species. It is a signal and unfortunate fact that in many parts of the country, especially where agriculture is particularly effective, many of the finest native species are rapidly disappearing. This applies to trees, shrubs and native herbaceous flowering plants. Many of these native plants are not noxious weeds in the ordinary sense. The weeds in fact are able to take care of themselves and do maintain their kind against the assaults of organized agriculture. Many shy and delicate species, however, of the utmost interest and beauty, give way quickly before the plow. These are the species which should be carefully protected by gardeners everywhere and which might with special propriety be encouraged along country roadsides.

Another similar service of the roadside plantings may be rendered in the conservation of native birds. These also, and especially the rarer and more interesting species, are disappearing before the encroachments of civilization. Some attention paid to the encouragement of birds in these roadside plantings would be highly justified on grounds of public policy.

There should be considered further the fact that the country roads everywhere constitute the most popular public parks in existence. The automobiles always take to the country roads, rather than to the city parks, from an absolute and almost universal preference. They find these roads more enjoyable than any other scenes. This suggests that the roads should have along many miles of their extent the same careful scenic treatment which is given to the scenery and plantings along park roads. This means not only skilful ornamental planting, but occasional cutting out of trees for opening up views, the removal of unsightly objects, the abolition of the roadside dump, and the subjugation of the billboard.

It may fairly be suggested further that in many parts of the country special scenic roads should be opened up, the main object of which is to develop stretches of fine scenery. These should in fact be laid on such indirect and circuitous lines as to prevent their use by business traffic. They would follow winding streams or the shores of lakes, or would climb over ridges of hills where the views were extensive. This is a

type of landscape gardening not generally undertaken anywhere in the world, but one which seems especially suitable to the genius of America.

Care and protection of trees.

While it is always desirable to have more extended plantings of trees both in city streets and along country roads, the preservation of existing trees presents nearly everywhere a more immediate and serious problem. Street trees are subject to many kinds of damage. Aside from the usual insect and fungous enemies, they have to contend against bad soil conditions, against the inroads of telephone linemen, trolley companies, gas mains, electric light wires, and all similar public utilities which have learned to use the road for their private profit, and largely to disregard the public rights in tree property. The regulation of gas mains and electric wires is perhaps the most difficult, as it is the most common, problem of all. In general, every effort should be made to remove wires from streets, and where this cannot be done, to see that they are kept out of the tree tops and everywhere properly insulated and stayed.

In certain parts of the country, public trees are considered of such great value that their care has been turned over to a special officer, the tree-warden. Such officers should have definite and fairly extended powers. Their business is to enforce the legal rights of the public in the trees, and to protect them from the attacks of private interests as well as from the attacks of insects and fungi. The tree-warden may easily be one of the most useful public officers in a municipality.

Along with an aroused public interest in trees, has arisen an army of "tree doctors," a considerable number of whom are low-grade quacks. Expert service in the repair and preservation of trees is everywhere to be encouraged, but very cautious discrimination must be exercised. It will not do to assume that the company getting out the biggest advertisements really knows the most about trees.

Town commons.

In the northeastern states nearly every village has its town common, a small central open space usually very attractive. It gives indeed a special character to each town which possesses something of this sort. In mid-western states there are somewhat similar "parks," usually open spaces of one or two square blocks in extent. In the southern and southwestern town there is often a courthouse square having somewhat the same character except that, unfortunately, the main public building is usually placed in its center. All such commons, parks, or squares, however, require pretty much the same horticultural improvement. In general the embellishment most desirable is to be found in fine well-grown trees. These should nearly always be of the same species and of the largest, most vigorous native kinds, rather than of any fussy "ornamental" species. Most public squares or commons are at their best when the horticultural treatment is confined to such large trees and smooth strips of lawn. The use of flower-beds on such grounds is to be generally reprobated. While their exclusion is not an absolute rule, the exceptions are very rare.

Shrubby borders are sometimes used on these town commons or parks. In special cases they may be justified, but the presumption is against them.

When public buildings are placed on such squares (they should always be placed outside the squares, facing upon them), it is frequently desirable to soften their outlines by foundation plantings. These should be of hardy shrubbery, usually such as has fine texture. Species of weedy growth (such as hazel and *Rosa carolina*) should be avoided. Species of coarse texture may be used with large coarse architecture, especially with heavy rusticated brick or stonework,



LXIII. View in a landscape cemetery.

and in positions where they will always be seen from a considerable distance. Attention should be given to placing on the north side of buildings those species which will thrive in shade, such as barberry, privet, rhododendron. On the south side should be placed plants which will withstand the sun; and perhaps some drought, for example, spirea, coral berry, ceanothus.

The treatment of parks is more fully discussed elsewhere (see *Parks*, page 1801).

School grounds.

School grounds throughout the country are generally neglected. They present a bare, unattractive appearance wholly inappropriate to their use. This condition is widely recognized and nearly every community is anxious to correct it. The problem, however, is difficult.

Generally speaking, large trees are the most useful amelioration for school grounds. These should be placed especially on the south and southwest sides of the school-house in order that the shadows may fall upon the building during school hours. Large-growing native species are particularly desirable, although throughout the northern states the common domestic apple tree seems entirely appropriate, especially for the rearward parts of school lots.

Good lawns are very desirable on school grounds wherever they can be maintained. They are, however, admittedly impossible in many cases.

Border plantings of shrubbery may be attractive, especially at the backs of school grounds, and more especially upon large grounds. Foundation plantings about the building are nearly always desirable when they can be maintained. Other horticultural embellishments such as flower-beds, are to be looked upon with disfavor.

On large school grounds such as every country district ought to have, there should be maintained school-gardens. In addition to the regular school-gardening work, good country schools should undertake to maintain small arboreta of native species. These may also be developed in the form of bird-gardens, adding interest to the grounds and supplying material for constant study.

Grounds designed for play must usually be bare. In some cases turf can be maintained, and is of course, desirable wherever it is possible to have it. Shade trees should be supplied wherever there is room, especially about the margins.

Church grounds.

The church grounds present no such difficulties as are found on the school grounds. They are rarely overrun by crowding multitudes. There is ample opportunity for every sort of horticultural improvement. It is surprising that this opportunity is not more widely acknowledged. The small country church is especially in need of good tree-plantings, but even in villages of considerable size the church grounds are large enough to use a number of large trees. Foundation plantings of shrubbery are effective with a great many church buildings, especially stone buildings of Gothic type with buttresses. The plain wooden churches of the Middle West also need foundation plantings wherever they can be supplied.

It would seem best in connection with many church grounds to develop pleasant outdoor playgrounds, social grounds, or even such places as would be particularly adapted to outdoor meetings. In many parts of the South and West, outdoor evening church services are decidedly popular during the long summer months. But definite and proper provision for them is rarely made.

Cemeteries.

The park cemetery is a distinctly American idea and is of such importance that it is more fully treated in a

separate article (see *Cemeteries*, page 1807). At this point we may merely call attention to the squalid unkept rural and village cemeteries, where very simple improvements would be highly valuable. These would consist chiefly of plantings of good trees and shrubs with such turf lawns as could be kept up.

State, county, and national parks.

Another form of the public improvement which is destined to play a conspicuous part in American life in years to come is the larger public park maintained by county, state, or by the nation. These all of course require extensive horticultural development, chiefly in the planting of trees and the maintenance of native shrubs and herbaceous species. The national forests really belong in this class. In them the conservation and exploitation of the tree flora has both an economic and a social value. This general matter, however, is discussed under *Parks*.

Home grounds.

Most village improvement undertakings make a strong point of the improvement of home grounds. This, however, is based entirely on the public interest, the public in fact, having a very great concern in the attractive appearance and sanitary condition of all home grounds. The horticultural treatment of the home grounds is a subject which has received very general attention in America. The selection of trees, shrubs, and other ornamental materials is naturally controlled chiefly by personal taste of private owners, and it seems impossible here, without going too far afield, to give specific directions on this sort of work. As the problem is approached from the village improvement standpoint, results are frequently aimed at through some form of emulation. Various kinds of public contests are established with prizes for the best-kept front yard, the best-developed back yard, for the best flower-garden, and so on. Where such contests have been wisely planned and tactfully directed, the results have been good.

FRANK A. WAUGH.

Landscape extension.

The field of university extension work in landscape gardening, or "landscape extension," is the education of the people of a state from the apathy that tolerates bare home grounds, badly planned cities, and wholesale destruction of native scenery and vegetation. Much work in this direction has been done, and always will be, by private landscape architects, by nurserymen, and by magazines and newspapers, but the best opportunity for educational work of a fundamental nature lies with the state universities and agricultural colleges.

Popular demand for landscape extension.

The most obvious demand for landscape extension is the endless succession of letters asking for help in designing and planting home grounds that are too small to justify employing a private landscape gardener. This need is met, to some extent, by commercial agencies that give "free plans" in order to get profits from the sale of planting materials. Some of the work done in this way is of good grade, but much of it is of a gaudiness and artificiality that represents a natural swing of the pendulum from apathy. The money and time wasted on the gardenesque style of planting has been saved to many individuals by showing them how nations and individuals pass through showy and artificial stages before arriving at the naturalistic. Letters from the people clearly indicate that they wish the guidance of public taste in landscape gardening entrusted to educational rather than commercial agencies.

A second popular demand for landscape extension comes from organizations that ask for help in making

comprehensive designs for communities. Such work is even more vital than designing home grounds, because it does not merely consider beauty, but goes deeply into the housing problem and all other factors involving the health and prosperity of every inhabitant. Ordinarily such designs must be made by city planners, but landscape-extension workers can render the state a worthy and invaluable service by helping to educate each community to the city plan as an ideal toward which local forces should work steadily, year after year.

A third popular demand for landscape extension is for technical advice on all public problems involving beauty. Road, bridge, drainage, and other projects often threaten the needless destruction of beauty which it would cost much money and many years to repair. Local protests are entitled to a fair hearing and organizations sometimes ask that expert valuation of the natural beauty involved be presented before courts, and legislative bodies. Organizations interested in conservation are continuously asking for advice on aims and methods, as well as popular lectures. The state legislature is besieged by various bodies with competing propositions for additions to the state park system. A logical outcome of all such unrelated efforts is a survey of each state's resources in natural beauty, showing low-cost lands unsuitable for agriculture, their location, size, character, ownership, salable value, relative importance to the people, dangers threatening valuable scenery and how these dangers can be avoided. Such a survey naturally leads to a comprehensive policy for state-owned reservations, and for some control of the great scenic features of state-wide interest, which, in states having no mountains, hills, or seashore, generally comprise water-courses of all kinds, including drainage-ditches, railroad and traction rights-of-way, and the roads. Some of these problems will be undertaken by private landscape architects through commissions, and some by state landscape architects, permanently employed, like state engineers and architects of state highways, waterways, health, sewers, buildings, and lands. Obviously, such work is related to landscape extension, and such commissions or officers may be located at the university for the same reason that a state often locates there such departments as the natural history, geological, and water surveys, and the like.

The aim of landscape extension is to teach the people the best ways of designing and planting public and private grounds for utility, health and beauty. Landscape extension is the democratic side of an art that has been too aristocratic. It is part of a national desire to popularize all the fine arts, as music and the drama have been brought into the daily life of the masses by means of mechanisms and moving pictures. Such aims can never be realized wholly by professional and commercial agencies since economic necessity often forces them to subordinate public needs to private gain. The people should have a set of representatives who decide every question relating to outdoor efficiency and beauty from the standpoint of the people. In this article all questions are so considered.

The lines of work are too varied to be treated here in detail. Some of the most obvious and popular ones may be named and illustrated in a constructive way under the five headings of individual, rural, town, corporation, and state opportunities.

Individual opportunities.

Designing farms and farmsteads.—Some work has been undertaken in several states in planning whole farms for efficiency, and men are now being trained for this work. Many farmstead plans have been made by students in agricultural colleges, under the direction of an instructor. Mail-order plans are not made by private landscape architects, and farmers, as a rule, will

not pay for a visit. The great opportunity of landscape extension is to show the farmers how to make surveys and furnish enough information to enable an expert to design the farm layout with the cost of a visit.

Home grounds in cities.—Technically the design of a small city lot is much the same as that of the farmstead, but with less chance for enframing views, more need of screening unsightly objects, and often a narrower range of materials, owing to smoke, gas, shade, and the like. City people are more eager to spend money on home grounds than country people. After a twenty-minute talk at Peoria, Illinois, 750 out of 2,600 persons signed pledges to do some permanent ornamental planting within a year. Later these persons were asked how they kept their promises. Those who replied had spent about \$8,000 in the two years, ending November 25, 1914.

Rural community opportunities.

Community plans.—Small communities can often direct their growth without expensive changes. Good work has been done in Massachusetts in designing rural centers. Facilities for such work will probably be furnished in several states under the Smith-Lever law. The census classifies as "rural" communities having 2,500 inhabitants or less. Some of these communities can afford to employ private city planners. Others may have to be designed by state aid, such as landscape extension can provide. Illinois has a community advisor and a director of community clubs who help local organizations federate toward the permanent improvement of rural communities.

County court-house grounds.—The planting of \$10 worth of vines on the walls of a court-house may be the first step toward a county plan, such as that made for Moore County, North Carolina. The farm advisor movement is beginning to bridge the gap between town and country. Trenton County, Missouri, is one of the first to unite all business men (including practically all of the farmers) in a single county improvement organization.

Township parks.—It is now recognized that country people need parks and playgrounds quite as much as city people, and that they are entitled to have something of a higher grade than amusement parks run by commercial interests. Leaverton Park, near Palestine, Illinois, is a high-class farmers' park organized under a little-known law permitting several townships to unite in levying adequate taxes for making and maintaining rural parks.

Town opportunities.

Town planning and planting for efficiency and beauty.—Massachusetts has a law requiring every city of 10,000 inhabitants or more to have a city plan. Such plans should be made by private landscape architects. The function of landscape extension is to promote the ideal of a city plan and to furnish, on request, the names of two or more competent city planners.

School grounds.—It often happens that money can be raised for planting, but not for plans. In such cases landscape extension may furnish designs. Such work is educational to children and townspeople, and the results, though quickly attained, are permanent.

Street trees.—The needless butchery done by wire-using corporations leads to frequent requests for lectures on street trees. Such efforts commonly result in the establishment of a shade-tree commission or city forester, controlling the corporations in harmony with laws like those of New Jersey, Ohio, and Massachusetts, as presented in Solotaroff's "Shade Trees."

Neighborhood planting.—Frequently the greatest improvement that can be made in the shortest time and at the least expense is to plant the front yards of a single street for three to five blocks. Shrubbery for foundations and for connecting the whole street into a

park can often be planted at a cost of \$15 to \$25 for a family. This work is expensive to a state, owing to the large number of persons whose taste must be educated to conform to a plan that will set a higher standard for the community. However, such effort greatly stimulates the planting of home grounds in all parts of a town. There is serious danger of debasing public taste by leaving neighborhood planting to commercial agencies that make no plans and merely plant "best sellers," especially curiosities and other gardenesque materials. Careful plans should be made by state aid in the many cases in which the cost of experts cannot be afforded.

Corporation opportunities.

Railroads.—The first duty of railroads toward public beauty is commonly thought to be the building of good stations and planting of station grounds. The Boston and Albany and the Pennsylvania have already begun to beautify their rights-of-way in a permanent and naturalistic manner. Theoretically, the principles of wild gardening can be applied to rights-of-way so as to save the wild flowers and shrubbery, with little more expense than the cost of mowing everything. It is probable that railroads running through monotonous, level countries, can restore or create a characteristic type of scenery at reasonable expense. Some even think that this can be done in such a way as to increase passenger traffic. The laws which, the railroads assert, compel them to cut down all brush and weeds, have been interpreted by lawyers to refer only to noxious vegetation.

Traction lines.—Interurban lines sometimes ask for advice on the merits of plans submitted for trolley parks. These are generally in the gardenesque style, where naturalistic treatment would be better for the people. At least one line has shown a disposition to get better plans and consider a comprehensive policy for all its parks and station grounds.

State opportunities.

State parks.—Every state needs large reservations of cheap land where the toiling millions may restore the energies necessary to do the world's work. Wisconsin and other states have reservations where laboring people who have only two weeks' vacation may camp amid wild surroundings. Every type of natural scenery should be represented, for scientific and educational purposes.

Waterways and drainage.—Great public improvements, like flood prevention and reclamation projects, are commonly conducted without regard to the rights of beauty. Competent landscape architects should be employed in all large engineering works affecting the face of nature. Water-courses are commonly treated as sewers and otherwise defaced. Landscape extension can arouse each local community to do its share toward restoring beauty to the watercourses.

Roadside planting.—Every state and county can have a great rural park system without the cost of buying land, by saving or restoring to the roadside the native trees, shrubs and flowers. The famous drives connecting Madison, Wisconsin, with the surrounding lakes, afford a good example. The comprehensive plan now being made for the Lincoln Highway, contemplates a consistent scheme of roadside planting from the Atlantic to the Pacific. Several miles of planting have lately been done near Monticello, Sidell, and Barrington, Illinois. The cost of restoration varies from \$500 to \$1,500 a mile, or about 10 per cent of the cost of constructing concrete roads.

State character.—One of the greatest opportunities of landscape extension is to show how every home and town may connect with a large scheme to give the whole state a characteristic beauty. The Middle West had developed a prairie style of landscape gardening

based upon conservation and restoration of native beauty and repetition of the horizontal line of prairie land or sky, by means of trees and shrubs with horizontal branches or flower clusters. One designer has submitted an itemized list of \$6,000,000 worth of work accomplished from his plans in the prairie style since 1901. Each state may have something like the "Illinois way of planting," which is the use of a high percentage of permanent materials native to the state.

Methods of landscape extension.

All activities of landscape extension except administrative, can be summarized under the heads of lectures, publications, and design.

Lectures.—These are necessarily illustrated, and high-grade colored lantern-slides are much more effective than plain ones. Before-and-after pictures showing money spent in the state on permanent native planting are more convincing than random, theoretical, temporary, or foreign subjects. Apathy may be indicated by those who stay away, but those who attend the lectures are generally enthusiastic to the point of making pledges, and of asking for more state aid in design than it is proper to grant. Mere enthusiasm for wholesale public planting often leads to poor arrangement, unfit material, and neglect of cultivation. Carefully organized campaigns give better results than individual lectures. Traveling expenses are paid by local communities.

Publications.—The traditional type is the practical circular, which is essential, but presupposes general interest in planting. The inspirational type is exemplified in a type or form of publication that contains many illustrations, for the reason that landscape gardening must be taught chiefly by means of pictures. Since truth in landscape gardening is not exact but comparative, the pictures may well be arranged in contrasting pairs.

Design.—In rich, old communities the people are not apathetic, but willing to improve if someone will show them what to do. Therefore, after every lecture, each community is likely to ask for a well-designed demonstration. In the West, many communities have no example at all of landscape gardening, or a poor and antiquated one. They will wait indefinitely unless the state supplies a standard. Such designs have been supplied on conditions about as follows:

1. The project must be educational. Therefore, it should not compete with landscape gardeners, and it should be the smallest unit that will stimulate a large amount of designing and planting.
2. It should be for public, not private, benefit. Therefore, front yards may be designed in street plans, but not back yards, except for corner and vacant lots where screening of unsightly objects may be necessary.
3. A reasonable guarantee must be furnished before the plan is made, that a definite sum of money will be spent, if the plans are acceptable, and adequate provision must be made for maintenance.

Some results of landscape extension.

At the end of its second year, the Division of Landscape Extension at the University of Illinois had 5,200 pledges "to do some permanent ornamental planting within a year." The signers were then asked to tell how they had kept their promises. The number who replied were 991, or 19 per cent of the signers. Of these, 206 spent nothing, while 785 spent a total of \$75,117 (not including labor), the average being nearly \$76. The mean expenditure of those who spent over \$100, was \$392. This class is composed of persons who can afford the services of a landscape gardener. The mean expenditure of those who spent less than \$100 was \$22. This represents the general public which commonly thinks that it cannot afford the services of a landscape gardener. The average expenditure (\$22)

is about five times as high as expected. Not all of this planting was due to the influence of landscape extension, for many persons had determined to plant something before they heard a lecture or read a circular. In such cases, the extension service often influenced the people to choose more appropriate plants and arrange them in better ways than they could have done without state aid or with commercial aid.

Relation to private landscape gardeners.

Obviously, landscape extension should develop in harmony with the principles laid down by the American Society of Landscape Architects for the elevation of the profession. It is a general policy for universities to show no favoritism and therefore always to suggest two or more men competent to do any particular piece of work.

Relation to nurserymen.

Landscape extension should be in sympathy with the ideals of the American Nurserymen's Association, so far as they agree with educational and professional standards. Incidentally, the propaganda creates much business for nurserymen, but its prime purpose is education. Therefore, when persons submit plans in the gardenesque style made by nurserymen, and ask for criticism, landscape extension workers should inform both parties simultaneously that the naturalistic style is considered superior to the gardenesque by the profession, and should furnish, on request, a list of landscape gardeners practising in the state. When prices are habitually excessive, the nurserymen, at least, should be informed. A university cannot recklessly promote mere quantity in planting; it must stand for quality and fair play. Landscape extension generally deals only with permanent materials, leaving to other agencies the promotion of temporary plantings, as well as fruits and vegetable-gardens.

Historical note.

The phrase "landscape extension" was used officially in February, 1914, at the University of Illinois. Prior to that, university extension work in landscape gardening had been undertaken in several states, notably in Massachusetts, but incidentally to regular teaching. The first state to employ a man to give his entire time to landscape extension was Illinois, where the work was begun in October, 1913. It is organized under the Department of Horticulture. Since then full-time workers have been engaged in Massachusetts, Iowa, New York and elsewhere.

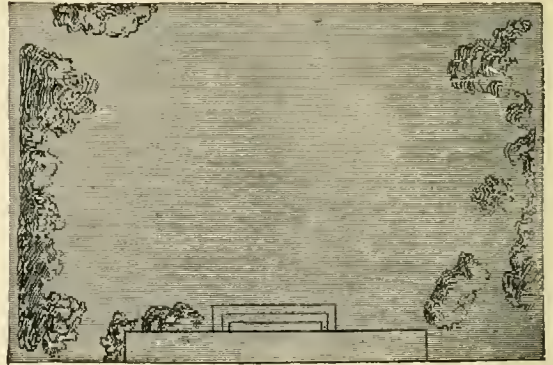
WILHELM MILLER.

Lawns and lawn-making in landscape planting.

For most persons the word lawn bears a vague meaning, compounded of their recollection of grass-covered spaces dotted over with trees and shrubs, and of broad areas covered simply with closely mown turf. Both are correct impressions; but the more important feature is that a lawn shall be an open area of grass space (Figs. 2104, 2105). Many exceptions or additions to this definition may, however, be admitted. A great white oak, for example, rugged and picturesque against the evening sky, needs only to be seen to furnish an ample excuse for its retention on any lawn. But this would be a happy chance, not affecting the principles which should govern the construction of a lawn on an open area.

It may readily appear that the lawn will, as originally designed, prove too sunny or too strongly wind-swept over its extended expanse; but the remedy for this will be found to lie not so much in planting single trees or detached groups of trees over the uncovered area, as in extending limbs, points, promontories and peninsulas of trees or trees and shrubs directly out from the main body of bordering plantations which will usually frame

the lawn and the different pictures that will appear in any properly unified scheme of landscape gardening. The art of the designer will display itself in determining the relative sizes of the lawns and these inclosing or framing plantations. A careful eye must, of course, be given to the individuality of the lawn itself, which



2104. Ground-plan of a nature-looking grass space, showing relative importance of lawn and planting.

should never be allowed to run over into the neighboring plantations. A like principle applies to all kinds of art—it is fundamental and vital in its character. The reader may fancy that its application would tend to limit the beauty of landscape gardening by eliminating certain features of natural beauty, such as trees, shrubs, and beds of flowers, but if he will look at an open lawn with discerning and sympathetic eyes, he will find that the "moving cloud-shadows, waving grass, rich patches of dark and light green, studded with the starry radiance of the humble flora of the grass, and the hundred incidents of blazing or subdued color and form that appear on the surface of an open meadow," need no added beauty of tree or shrub to perfect their nearly unapproachable loveliness. So important does the writer consider the essential and peculiar beauty of the lawn as distinguished from that of any other part of the home domain, that he always feels inclined to term it the true focus of the picture, the central point of interest in any landscape gardening design.

This being the case, it behooves us always literally to leave no stone unturned or clod of earth untilld and unfertilized in order to secure a satisfactory open lawn. Did the reader ever see such an one? Let him answer frankly to himself whether he has or has not seen a lawn which showed no traces of quick-grass and other early weeds in July, nor any summer grass and later weeds in August and September,—above all, a lawn which would stand a protracted drought without artificial watering. Very likely he will think it is impossible to make such a lawn under the conditions of soil and climate which each and all of us are apt to believe specially characteristic of the spot of ground on which we live. Perhaps, on the other hand, he will declare that he has seen such a lawn in some remote place, but if we question him, ten chances to one we shall find that his observation of this exceptional lawn is limited—that he has not wintered and summered near it, or seen it during its periods of "storm and stress." The writer knows one place where such a lawn can be seen, and he refers to it, not because it is properly a lawn, for it lacks the requisite framing plantations; but it is perfect in the first essential of a good lawn—it is a piece of perfect lawn grass. A brief description will show how this standard of excellence was reached. The lawn consists of small patches of grass turf on a private farm in Manchester, Connecticut. Each patch was worked and turned over with various ingeniously contrived hoes, forks and rakes until the last lurking weed was removed

that could be found by dint of skill and untiring patience. The soil was that of an old garden, and naturally good. It was tilled in the most thorough manner and not fertilized at all, for fear new weeds be introduced. Then, in this mellow and receptive medium, were set cuttings or joints of the hardiest and most luxuriant varieties of grasses which had been discovered by months and even years of keen and intelligent search in the old meadows of both the Old and the New World from Austria to Australia. The result is an elastic firmness, an endurance, depth and richness of the turf which suggests to the tread the deep pile of some Eastern carpet woven in a hand-loom.

But all can not attain this standard on their lawns. For those who do not look higher than the ordinary standard—and even this is none too often desired, or even understood, by the general public—the following directions for lawn-making may be given:

1. The lawn should be carefully graded, either convex, level or concave, in such comparatively long, suave and graceful lines as will accord with the peculiar conformation of the ground (Fig. 2106).

2. Plow, harrow or spade, and fork the soil of the lawn to a depth of 2 feet, if possible, and keep removing the stones and burning the gathered rubbish for several weeks, or as long as you can persuade yourself to do it, or pay anyone else to do it; with the full assurance that no matter how much you do, you will not be likely to destroy all the weeds and win the very best possible results.

3. Enrich the soil by a covering of still richer mold. Next to this in efficiency are bone-dust, lime, superphosphate, nitrate of soda, and nitrogenous manures like ground flesh and bone mixed in proportions suited to the special soil, which may vary materially in a distance of a few hundred yards. The usual proportions are one ton to the acre of ordinary artificial fertilizers, such as superphosphate of lime and bone-dust, or fifteen to twenty-five of well-rotted stable-manure. If artificial fertilizers are not available, then take cow-manure, sheep-manure, or last of all, because it is the most productive of weeds, ordinary stable-manure. These natural manures are, after all, the best, save for their weed-bearing qualities. They will need composting with several times their bulk of good soil and even spreading and harrowing or raking in throughout the surface of the lawn.

4. For turfing, the cleanest grass seed that can be obtained at any price will be found the best in the end. The bulk of this seed should be Kentucky blue-grass or June-grass (*Poa pratensis*) mixed with red-top or herd's-grass (*Agrostis alba* var. *vulgaris*), or *Agrostis canina*, the Rhode Island bent-grass. The advantage of using several kinds of grass is that the first-comers hold possession of the ground against incursions of weeds until the stronger but slower-growing Kentucky blue-grass gets complete foothold, when, in the struggle for life, the earlier growths of grass, being weaker, go to the wall and are crowded out of existence. How fine this blue-grass may become under favorable conditions it will be needless to point out to those who have seen the grass meadows of Kentucky.

5. On a calm day the seed should be sown evenly over the lawn surface—a task which can be well done only by much skill and experience. The ground will then need careful raking with a fine-toothed iron rake, and rolling with an iron roller, the heavier the better. In very dry weather or very windy weather it is hardly worth while to sow grass seed.

6. As soon as the grass has grown 3 or 4 inches, cut it

first with a scythe and afterward with the lawn-mower, in order to secure a good thick-set turf. Every spring, and oftener if wet weather prevails, a compacting with the iron roller will serve a good purpose. Fertilizing on the top of the lawn in the winter is always in order, provided the remainders of rubbish from the stable-manure that may be used be removed early in spring before the grass starts.

7. The last and perhaps the most important care to be given the lawn in the process of its establishment is the weeding of the first summer. The next is the weeding of the second summer—and the third is the weeding at any time it may need it, no matter how many years may have elapsed since its construction. The onion-patch and the flower-garden need no more weeding than the lawn, if for no other reason than because the use and beauty of either onion-patch or flower-garden can never, combined, equal those of the home lawn. In it, skill and patience and the love of beauty find abundant reward.

SAMUEL PARSONS.

Lawns for the South.

For many years handsome lawns in the South were a rarity, and it was the impression, generally, that good lawns were not possible in that region. Unfortunately, many kinds of grasses not suited to certain sections of the South were sown. Being unadapted to the soil and climate, consequently failure followed.

By careful and judicious selection of the hardier varieties of grasses, and a proper and careful blending of them, beautiful lawns are now possible in almost every part of the South, but, to be successful, the soil must be properly prepared and fertilized. Most of the southern soils contain an excess of acidity, and, therefore, this must be corrected by an application of lime. This should be used at the rate of 1,000 to 3,000 pounds to the acre, and should be evenly distributed over the area to be treated. Soils lacking in humus should have this deficiency supplied by the following treatment: Cowpeas, soy-beans and velvet beans should be sown in the spring, and crimson clover in the fall, and when matured, cut and allowed to lie upon the ground for a few days, then chopped up fine with a cutaway harrow, and properly turned under, so that none of the stems and roots remains on the surface. Apply a good high-grade fertilizer, bone-meal, sterilized sheep-manure,



2105. An open area of grass space.

or a material containing a high percentage of phosphoric acid, nitrogen and potash. Apply at the rate of 500 to 800 pounds to the acre. This should be thoroughly incorporated with the soil. In the spring, previous to preparing a lawn for fall seeding, thoroughly rotted barnyard manure can be used. The only objection to barnyard manure is the risk of bringing foreign weeds and grass seeds into the lawn. Before putting in the seed, the ground must be very carefully graded and raked smooth. Seeding should be done at the rate

of fifty to one hundred pounds to the acre, according to the varieties used. Rake in the seed lightly and then roll. Never attempt to sow grass seed on a windy day. In the spring a top-dressing of bone-meal should be applied.

Mow the lawn regularly. Water when needed, but apply so it will fall lightly on the ground. Many lawns are ruined by applying the water with too great force.



2106. An easy grade for a lawn.

For the extreme South, Bermuda-grass (*Cynodon Dactylon*), St. Augustine-, Charleston-, or goose-grass (*Stenotaphrum secundatum*) are the best. About Miami, Fla., a fine-leaved form of Korean lawn grass, *Osterdamia matrella* (*Zoysia tenuifolia*) is very successful, withstanding drought well. The Bermuda is a plant of trailing and stoloniferous habit. It is a native of India. It is widely disseminated throughout the South and is a most valuable and reliable grass for pasture. Unfortunately, with the first approach of frost it turns brown and does not present an attractive appearance during winter.

When it is not desired to tear up a Bermuda lawn, it can be given a bright and cheerful aspect during winter by first cutting the Bermuda-grass very close, then scarifying same with a rake or small cutaway harrow, the blades set straight so as not to turn up the lawn, applying a liberal amount of bone-meal and sowing a good lawn grass adapted to the locality. Rake this in and roll.

A Bermuda-grass lawn can be made by cutting the roots in short lengths, chopping with a hatchet, or passing roots through a feed-cutter, and sowing the roots broadcast, and plowing in lightly; or the uncut roots may be planted in furrows, same covered to a depth of 4 inches, the ground then leveled and rolled. The roots may be planted in autumn, or from February until May, but, when they are planted late, care must be taken that the roots are not exposed to the sun so as to dry out. The Bermuda-grass will give excellent results if kept well enriched and frequently mowed. It adapts itself to almost any soil, except that which is extremely wet.

The St. Augustine-grass is an early-growing perennial plant, with flat or channelled leaves. It is found naturally in the pine-barren swamps and ponds from Florida to North Carolina, and it is well adapted to the sandy soil of the coast, even those which are commonly termed "salt-water lands." It is, therefore, of unquestionable value for such localities. This grass is grown from rootlets, planted in rows a few inches apart, but, to get the best results, the soil must be well prepared and fertilized. It requires frequent applications of the lawn-mower. It is a coarse grass, but has a good color and adapts itself to soils where few other grasses are possible.

Joint-grass (*Paspalum distichum*) is a native of the South and is usually found in moist or low grounds. It can be utilized in soils that are too wet to suit Bermuda, but, at best, makes an indifferent lawn, as it is of low creeping and not sufficiently dense habit.

For the middle sections of the South, some good mix-

tures of the different hardier grasses, thoroughly tested, have been made, and when the ground has received the proper preparation, satisfactory results have been attained.

For the upper or mountainous sections of the South, blue-grass and many of the mixtures of the hardier grasses are very successful.

L. A. BERCKMANS.

LÁNSIUM (from the Malayan name *lansa* or *lanseh*). *Meliaceæ*. A small group of oriental trees, of which one species is cultivated for its edible fruits.

The genus is allied to the umbrella tree (*Melia*) grown in the S. U. S., and the tropical mahogany (*Swietenia*). Lvs. imparipinnate: fls. produced in axillary panicles; sepals 5, petals 5, the 10 stamens formed into a tube: fr. a berry, 5-celled, each cell containing 1 or 2 seeds.—Species about 4, in India and Malaya.

domesticum, Jack. **LANGSAT**. **LANSA**. **LANSEH**. **LANZON**. **AYER AYER**. A medium-sized, rather slender tree, native of the Malayan Archipelago: lvs. with 3 or more pairs of elliptical to obovate, alternate, shortly petiolulate lfts., about 4-6 in. long and 2-3 in. broad: fr. globose or ovate, 1-1½ in. long, calyx persistent, the sepals small, dry, brownish; seeds 1 or 2 developed, remainder usually aborted, of variable size, oval; testa membranous.—The langsat is frequently seen in the markets of Manila, Canton, Singapore, Penang, and other cities in that part of the world. The round to oval frs. are borne in clusters, and are not unlike loquats in general appearance, except that the color is a dull straw or brownish yellow, and the thick leathery skin, which does not adhere to the flesh, is pubescent on the surface. The flesh separates into 5 or less distinct segms. like those of an orange, and is white, translucent, very juicy, and of a subacid pungent flavor, sometimes varying slightly of turpentine, especially if the thin membrane which surrounds the segms. gets into the mouth. It is eaten fresh or prepared in various ways. Ward wrote that the langsat "is by many reckoned the finest fruit in the peninsula. The month of July is the season at Malacca when it is had in the greatest perfection." Its season extends to Sept. A variety known as "duku" or "doekoe" is larger than the type, and considered much the better of the two. Both the duku and the langsat are commonly planted in gardens, and spring up along the roadsides. They have recently been planted in S. Fla. and the W. Indies. The duku is produced in smaller clusters than the langsat, and is spherical in form, varying from 1-2 in. diam. The skin is about ¼ in. thick, leathery, dull brownish yellow in color, covered with a thick grayish pubescence. The flavor is very pleasant and refreshing, scarcely comparable to that of any temperate fr. The seeds retain their vitality for some time, if not allowed to become too dry, and germinate readily when planted in light, loamy soil. Seed prop. is the only method known to be employed in Malaya.

F. W. POPEOE.

LANTANA (old name, once applied to a viburnum). *Verbenacæ*. Mostly shrubs or undershrubs, sometimes half-climbing, with opposite or verticillate rough dentate leaves, and spikes or cymes of small verberna-like flowers; one species or group much grown by florists, and a few others sometimes planted.

Plant scabrous, hirsute or pubescent: fls. small, red, orange, white or otherwise, in dense spikes or heads, gamopetalous, the calyx very small, the corolla somewhat irregularly 4-5-parted but not bilabiate, the corollatube slender; stamens 4, didynamous, attached midway in the tube, included; ovary 2-loculed, becoming a fleshy or dryish drupe with 2 nutlets: bracts subtending the head often imitate an involucre. Verberna differs in having achene-like nutlets and long-tubular 5-

toothed calyx.—Species probably 50, mostly in Trop. and Subtrop. Amer., but also in the Old World. Lantanas have been long in cult., and it is difficult to refer the garden forms to botanical species. The species themselves are confusing. Most of the garden kinds are of the *L. Camara* type. There are several camara-like species which probably have hybridized to produce these forms; but Voss regards these species as only forms of *L. Camara* (preferring, however, to use the name *L. aculeata*). Accepting *L. Camara* in Voss's sense, the garden lantanas may be said to be derived from that species; and this view is adopted below. In recent years, a strain of very dwarf varieties has become popular as border plants. The lantanas are free-flowering in winter and summer, but an odor of foliage and flowers that is disagreeable to many persons prevents them from popular use as cut-flowers. They are very useful in window-gardens and the dwarf kinds make good subjects for hanging-baskets. From the window they may be transferred to the open in summer, where they bloom profusely.

The culture of the florists' lantana is relatively simple. It is grown under glass for bloom in cold weather and also in the open in summer. It has been improved in its usefulness as a bedding-plant of late years, largely through the efforts of French hybridists. The older varieties were mostly rather tall and lanky, later in coming into bloom, and dropped their flowers badly after rain-storms, but were showy in warm and dry weather. The new varieties are dwarf, spreading and bushy in habit, early and free-flowering, and the heads or umbels of bloom average much larger, with florets in proportion; nor do they drop from the plants as did the old varieties in bad weather. These newer kinds are not so well known as they should be. They are very desirable for any situation where sun-loving bedding plants are used, in groups or borders, window-boxes, baskets and vases.—The lantana is not particular as to soil, provided the exposure is sunny, and also that the soil is well supplied with moisture at least until a fair growth has been made. When well established the plants do not seem to mind drought, and continue bright and attractive in the hottest weather. They should not be transplanted out in the open before danger of frost is over. If the old plants are wanted for propagation, cut them back and transfer to pots early in September, and when they start into new growth the soft wood will furnish cuttings that root easily. Keep young stock in a warm position through the winter months, and repot in April.—Save the old plants, after frost has nipped their freshness late in autumn, prune severely back, remove them indoors, giving them a temperature anywhere above 40°, and with a little attention and fresh soil, every plant will be a perfect specimen, covered with blooms in May. Gardeners train them into fine standards, as prim and shapely as need be. Among the French varieties are very dwarf spreading growers, about 8 inches high. (Grove P. Rawson.)

A. Plant mostly spiny (at least when wild); fr. juicy.

Cámara, Linn. (*L. aculeata*, Linn.). Fig. 2107. Small shrub, 1–4 ft. high, hairy, sometimes with short hooked prickles; lvs. rather thick, rugose, scabrous above but pubescent beneath, ovate or cordate-ovate, mostly short-acuminate, crenate-dentate, the petioles short; clusters of fls. on strong axillary peduncles which may or may not exceed the lvs.; fls. in a dense, nearly flat-topped head, usually opening yellow or pink but changing to orange or scarlet, the bracts narrow and not conspicuous. Trop. Amer., extending north to Texas and S. Ga. B.M. 96. L.B.C. 12:1171 (as *L. scabrida*, Ait.).—In the wild, the plant may grow 10 ft. high, and it is usually prickly (hence the name *L. aculeata* of Linnaeus). The cult. plant is less prickly or even unarmed. Color of fls. varies on different plants, and there are many

named forms. This group is now a prominent plant in many tropics. It is possible that more than one species is involved in the following forms. *L. híbrida* is a name for the dwarf garden forms. *L. Pictavi* is a hybrid between *L. Sellowiana* and a garden form.

Var. *nivea*, Bailey (*L. nivea*, Vent.). Fls. white, the outer ones becoming bluish; heads rounder. B.M. 1946.

Var. *mutabilis*, Bailey (*L. nivea* var. *mutabilis*, Hook.). Remarkable for the change of color in the nearly globular heads: in little more than a day, the fls. may change from white through yellowish, lilac, rose and blue. The outer fls. open white and run through yellowish, rose and lilac; the inner ones open yellowish. B.M. 3110. R.H. 1852:461.

Var. *mista*, Bailey (*L. mista*, Linn. Not spelled *mista* by Linnaeus, although it is so spelled by later authors). Outer fls. opening yellowish and becoming saffron and brick-red; inner fls. yellow, changing to orange. Said to be distinguished by numerous recurved prickles on the branches.

Var. *crœcea*, Bailey (*L. crœcea*, Jacq.). Fls. opening sulfur-yellow and changing to saffron. R.H. 1852:461.

Var. *sanguinea*, Bailey (*L. sanguinea*, Medikus). Fls. opening saffron-yellow, changing to bright red.

AA. Plant not spiny; fr. either juicy or thin-fleshed.

lilacina, Desf. Particularly recommendable in S. Calif. for its upright panicles of rosy lilac shining berries, which persist through the winter: erect, with



2107. *Lantana Camara*. (×½)

spreading 4-angled hirsute branches: lvs. opposite, ovate to oblong or lanceolate-triangular-acute, the base rounded or slightly cordate, crenate, hairy-scabrous above and velutinous beneath; fls. rose-lilac with yellow throat; berry succulent. Brazil.—The *L. purpurea* of Cyclo. Amer. Hort., 1900.

salvifolia, Jacq. (*L. salvifolia*, Mey.). Erect, much branched, aromatic, unarmed, 3–6 ft., pubescent

on young parts: lvs. opposite or in 3's or 4's, short-petiolate, oblong-ovate, rounded or subcordate at base, obtuse or somewhat acute, crenate-serrate, pubescent, punctate-glandular: fls. lilac or pink in a subglobose or cylindric peduncled axillary spike; calyx tubular, not ribbed, but more or less distinctly 4-nerved, obscurely 2-lobed or 4-toothed; corolla-tube straight, slightly dilated about the middle, pubescent above on outside but glabrous within, $\frac{3}{4}$ – $1\frac{1}{2}$ in. long; fr. a purple subglobose drupe with sweet edible pulp, used for food in Zululand in times of scarcity. Trop. and S. Afr. *L. salviaefolia*, Hort. (?)

trifolia, Linn. (*L. annua*, Linn.). Half-shrubby, hairy: lvs. ovate-lanceolate or elliptic-oblong, pointed, crenate-dentate, in 3's or 4's: heads becoming ovoid or oblong, the involucre not conspicuous; fls. rose-lilac varying to white, with yellow throat; fr. rather pulpy, showing well amongst the bracts. Trop. Amer. B.M. 1449.—The name *L. annua* seems to have been applied to young plants, on the impression that they were annuals. The picture of *L. annua* in B.M. 1022 is quite as likely to be a form of *L. Camara*. Little known in cult.

Sellowiana, Link and Otto (*L. delicatissima*, Hort.?).

WEeping or TRAILING LANTANA. Twiggy, slender plant with lopping or trailing pubescent branches: lvs. small, ovate, tapering below, close-toothed: fls. small, in long-stalked small heads, rosy lilac, the outer bracts or scales of the involucre broad-ovate and hairy and half or less as long as the slender pubescent corolla-tube. S. Amer. B.M. 2981. B. 3: 115. R.H. 1852: 461 (?).—A very profuse bloomer in both winter and summer, and most desirable for



2103. *Lapageria rosea*.
(X about $\frac{1}{2}$)

pot or basket cult. Should be better known. Verbenalike. The plant seems to be an escape in Fla.

involucrata, Linn. Low, much-branched bush, with obscurely 4-angled gray branches, and blunt, ovate, small, crenate-dentate lvs.: fls. small, nearly or quite equaled by the ovate involucre-bracts. Trop. Amer., reaching north to S. Fla. and S. Texas.—Said to be occasionally cult. indoors for the light lilac or white fls.

L. H. B.

LAPAGÈRIA (from a personal name, probably for the Empress Josephine, née Tascher de La Pagerie). *Liliacæ*. CHILEAN BELLFLOWER. A single species, a noble, half-hardy evergreen twiner, allied to the smilaxes, considered to be one of the choicest subjects to grow under glass.

Leaves alternate, lance-ovate or cordate-lanceolate, 3–5-nerved, acuminate: fls. large and showy, bell-shaped, hanging singly from the upper axils or somewhat racemose at the end of the vine, about 3 in. long; stamens 6, borne on the torus or slightly attached to the base of the inner segments, shorter than the perianth; ovary sessile and 1-loculed, with 3 parietal placentae, ripening into a 3-angled, oblong, fleshy, indehiscent, berry-like beaked fr. and bearing nearly globose seeds imbedded in the pulp. *L. rosea*, Ruiz & Pav., is the only species. Fig. 2103. It has rose-colored or

rose-crimson fls., with lighter spots. Chile. B.M. 4417. F.S. 5:491; 20:2059–2060. R.H. 1850:101. Gt. 47, p. 101. G.C. III. 20:657 (frs.); 25:45. Gn. 34, p. 321; 48, p. 475; 49:174; 55, p. 57. G. 1:557; 18:626; 34:753. G.W. 14, p. 328. H.F. II. 6:40. Gng. 5:356. Mn. 7:191.—The species is variable in vigor, floriferousness, size, color and substance of bloom, and there are a number of named horticultural subvarieties. Var. *albiflora*, Hook. (var. *alba*, Hort.), has white or whitish fls. B.M. 4892. R.H. 1852:441. F.S. 20:2059–2060. Gn. 41, p. 53; 49:174 and p. 175; 54, p. 277. J.H. III. 61:349. G.W. 10, p. 8. G. 2:387; 5:409; 17:271; 32:335. F.S.R. 2, p. 221. A.G. 13:745. Gng. 2:187; 5:356. Var. *superba*, Hort. Fls. large, brilliant rich crimson. Var. *flsemanni*, Hort. Fls. larger and more brightly colored than those of the type itself; vigorous and free-flowering. Gt. 46:1445. Var. *Bénsonii*, Hort. Fls. of lighter tint than those of type, especially in interior of the perianth. Var. *gattoniensis*, Hort. Much like the type. A double-fl. form of the white variety is shown in G. C. II. 17:777.

Lapagerias are tall-twinning plants, suitable for rafters or walls in coolhouses, or for culture in the open in the milder parts of the country. They are commonly propagated by cuttings and layers, but strong plants may be secured from seeds, although varieties may not come true. The first live plants were introduced into England in 1847. Lapagerias should be seen more frequently in America. They are considered to be not easy to grow, and a good display is usually regarded as an evidence of skill. Franceschi says that in California the plant prefers shady places "where the atmosphere will never become too dry."

Lapageria rosea and *Philesia buxifolia* have been hybridized by Veitch, producing a plant known as *Philageria Veitchii*, Mast. (G.C. 1872:358). *Philesia* afforded the pollen. It is not in the American trade, but is a most interesting hybrid. For an anatomical study of it, bearing on problems of hybridity, see J. M. Macfarlane, Trans. Roy. Soc. Edinburgh, 37, pt. 1, p. 207 (1892).

L. H. B.

Lapageria rosea and var. *albiflora* should occupy a position in all cool greenhouse collections. We have no cool greenhouse twinning plants that can be compared with them. They can be grown in large pots, trained on a trellis as specimen plants, or if for cut-flowers, they may be planted out on a bench or in a border. Strict attention must be paid to drainage, and the soil must not get into a "sour" condition.—Layering is the best way to propagate lapagerias. When a shoot gets somewhat bare of foliage, it may be twisted backward and forward in a box near where the plant is growing. The box should be filled first, with sand and fine peat, in equal proportion, to the depth of about 3 inches. Peg the shoot to keep it in position and cover with some of the compost. If there are leaves on the shoot, cover them only about one-third. Keep the soil moderately moist; and in time growths will start from the joints, which after a while will throw out roots, and when a sufficient number are formed to support the plants, separate them from the stem and place them in pots large enough to receive the roots without breaking them. The potting material should be one part fiber of loam, out of which all the fine loam has been shaken, one part osmunda fern root (osmundine), one part charcoal, and one part sharp sand. Water carefully until they get a good hold on the compost, after which they may be kept moderately moist.—Lapagerias require to be at all times shaded from the sun, and kept in as cool a temperature as possible. A north house, from which the frost is kept, is an ideal position. If the plants are to be grown in pots, they must be shifted into larger pots before they get too well rooted. This will encourage strong breaks to start from the bottom. These shoots, as soon as they emerge from the soil,

should have a piece of cotton-wool twisted around them, for if there are any snails nearby, they will be sure to eat the tender tops, which will ruin the plants. A few stakes should be placed around the pot, to which to tie the shoots, until such time as the plants are big enough to train on the permanent trellis. Be sure to tie them in a regular way, as they will be easier untwisted when the time arrives for their removal.—If lapagerias are intended to be planted on a bench or in a border, they should be well established in pots first. Do not fill all the bench or border at once; it is better to supply only enough material to last for one season, adding a little each year as they require it. The compost should be same as advised for potting, and it should be in rather a lumpy state, as lapagerias do not thrive in any soil of an adhesive nature. The bench or border should be well drained, so that the water may pass through freely, copious supplies being necessary when they are in active growth. After they are well established, treat with manure-water as advised for ixoras. Insect pests may be destroyed by fumigating with hydrocyanic gas in cool weather, and a free use of the syringe at all times. (George F. Stewart.)

LAPEYROÛSIA (Jean François Galoup de Lapeyrouse, distinguished French naval officer, born 1741). *Iridaceæ*. African bulbs, something like freesias, but with mostly blue or red flowers, produced in summer instead of spring.

Corm with matted tunics or coverings, flattened at the base; lvs. usually only 1 or 2 to each st. (sometimes several), very narrow, in some cases nearly terete, distichous; peduncle mostly branched; fls. small, red to white and yellow; perianth-tube subcylindrical, long or short, somewhat dilated upward; segms. nearly equal, spreading, oblong-lanceolate; stamens inserted in the throat; ovary 3-celled: fr. a small caps., oblong or globose, loculeidial.—Species about 50 in Trop. and S. Afr. By dealers they may be listed under the name of *Anomatheca*, which Baker has reduced to one of the 3 subgenera of *Lapeyrousia*, characterized by having several lvs. forming a 2-ranked basal rosette, accompanied by a long, branched st. *Lapeyrousia* is further distinguished from *Freesia* by having a more slender perianth-tube, with the stamens inserted at the throat instead of below; also by the ovules being more regularly superposed instead of crowded together. The species of *Lapeyrousia* have an egg-shaped or globose corm about $\frac{1}{2}$ in. thick, and matted with tunics: lvs. linear or sword-shaped; infl. various, often a loose, 1-sided, more or less zigzag spike, as in *Freesia*; fls. variously colored, 1–2 in. across; perianth-tube long or short; segms. spreading, 3 larger than the other 3.

Some of the *lapeyrousia*s can be grown outdoors in the North with some winter covering, and are said to be quite hardy south of Washington, D. C., if planted deep. These plants will probably never have anything like the degree of popularity enjoyed by freesias, because of their later season of bloom and lack of fragrance. Probably the most popular kind is *L. cruenta*, which grows 6 to 10 inches high, blooming in summer and fall. In a sheltered place and in light, porous soil it generally succeeds in the North without any protection, but the bulbs are safer in very severe winters under a covering of litter or straw. The bulbs increase rapidly, and should be divided every few years before they become too crowded.

A. Color of fls. chiefly blue or violet.

corymbosa, Ker. (*Ixia corymbosa*, Linn. *Anomatheca corymbosa*, Hort.). This belongs to the subgenus *Ovieda*, having usually 1–2 basal lvs., while the next 3 species belong to the subgenus *Anomatheca*, having more numerous lvs. *L. corymbosa* has 1 basal lf. which is spreading, sword-shaped, 4–6 in. long; infl. a dense flat-topped cluster of as many as 15 fls., each about 1

in. across, with practically regular segms., blue, with a star-shaped white figure near the throat, outlined in black after the fashion of Quedlinburg phlox. S. Afr. B.M. 595. J.H. III. 32:379.

AA. Color of fls. red, with 3 darker spots at the base of the 3 smaller segms.

B. Size of fls. 2 in. across.

grandiflora, Baker (*Anomatheca grandiflora*, Baker). Lvs. 1 ft. or more long; fls. bright red; stamens as long as the segms.; the 3 style-branches each 2-cut. Zambesi S. B.M. 6924.—A newer species than *L. cruenta*, and perhaps destined to greater favor. Corm globose (ovoid in the others here described).

BB. Size of fls. 1 in. across.

cruenta, Benth. (*Anomatheca cruenta*, Lindl.). Lvs. $\frac{1}{2}$ –1 ft. long; segms. bright carmine; stamens less than half as long as the segms.; the 3 style-branches uncut. Transvaal, south. B.R. 1369. L.B.C. 19:1857. P.M. 1:103. J.H. III. 31:397.

júncea, Pourr. (*Anomatheca júncea*, Ker.). Lvs. strap-shaped (linear in the 2 preceding species), 6–8 in. long; segms. pale red or rosy; stamens half as long as the segms. Coast region, S. Afr.—Less known in cult. than the others.

WILHELM MILLER.

LAPÓRTEA (François L. de Laporte, entomologist of the nineteenth century). *Urticaceæ*. Perennial herbs, shrubs, or trees, a few species of which are sometimes grown in glasshouses for the showy foliage or fruits.

Leaves alternate, often large and variously colored, mostly dentate; fls. monœcious or diœcious, clustered in loose cymes, small and inconspicuous; sterile fls. with a 4–5-parted perianth (or separate sepals), 4 or 5 stamens, and rudiment of an ovary; fertile fls. with 4 sepals or 4-lobed perianth, the 2 outer usually much smaller: fr. an ovate or oblique compressed achene.—Species 40–50, widely scattered, mostly of tropical countries; one *L. canadense*, reaches to Canada. They are provided with stinging hairs, and must be handled with caution. The horticultural species are prop. by seeds, and also by cuttings started in heat. The generic name *Laportea* is retained in the “nomina conservanda” of the International Code as against *Urticastrum*.

Three species-forms appear to be best known in cult., as follows: *L. Schömburgkii*, Bull. Ornamental-lyd. plant (usually known as var. *versicolor*) from Polynesia: lvs. large, with fleshy petioles and deciduous herbaceous stipules; blade deep green, with purplish rib and veins, mottled with gray-green and cream-white, sometimes one-half being creamy white. G.Z. 20, p. 145. *L. gigas*, Wedd. Tree, to 80 ft., India to Austral.: lvs. broadly cordate-ovate, obtuse or short-acuminate, more or less sinuate-toothed, 10–12 in. or more long. *L. moroides*, Wedd. Shrub or small tree of Queensland: lvs. broadly ovate, 6–8 in. long and nearly as broad, peltate at base, short-acuminate, prominently toothed: fr. mulberry-like, purple, borne beneath the crown of lvs. and remaining for nearly a year. B.M. 7057. Gn. 61, p. 71. Gt. 54, p. 289 (also 49, p. 68 as *L. gigas*). A showy greenhouse plant, worthy of attention except for the virulently stinging hairs.

L. H. B.

LÁPPA: *Arctium*.

LÁPPULA (diminutive of *lappa*, a bur). *Boraginaceæ*. Annual, biennial or perennial herbs, of probably forty species, some of them native in North America. They are related to *Myosotis*, but lack sufficient horticultural character to bring them into the trade-lists. In the older manuals they are known under the name *Echinospermum*. The four little nutlets are burs and adhere to clothing, and the plants are mostly weedy in appearance. The flowers are blue or whitish, small, in spikes or racemes.

LARCH: *Larix*.

LARDIZABĀLA (after the Spanish naturalist Lardizabal y Uribe). *Lardizabalaea*. Two shrubby evergreen climbers in Chile with once- to thrice-ternate lvs.; fls. dioecious, purple-brown; sepals 6, and 6 petaloid nectaries, sometimes called petals; the staminate fls. in pendulous racemes, with 6 connate stamens; the pistillate ones solitary, with 6 distinct sterile stamens and 3 cylindric ovaries, developing into oblong, many-seeded berries. The pulpy edible fr. is sold in the Chilean markets and cordage is made of the fibrous sts. Only the following species, which is similar to the well-known *Akebia quinata* but has short-stalked pointed lfts. in 3's, is cult. in S. Calif. for its handsome foliage and the odd-looking dark-colored fls.; it is readily prop. by cuttings of half-ripened wood under glass. *L. biternata*, Ruiz & Pav. Lvs. twice ternate or on the flowering branchlets usually simply ternate; lfts. leathery, ovate, acute or mucronate, entire or with 1 or 2 almost spiny teeth, dark green and glossy above, paler and reticulate beneath, 2-4 in. long; staminate fls. about 1 in. across, purple-brown, in a dense, about 15-flid. drooping raceme; the petaloid nectaries lanceolate, white, the pistillate fls. slightly larger, solitary, slender-stalked; fr. oblong, 2-3 in. long. Winter or spring. B.M. 4501. G.C. III. 52:467. Gn. 28, p. 489. J.F. 1:5. B.H. 3:339. P.M. 1, p. 28.

ALFRED REINDER.

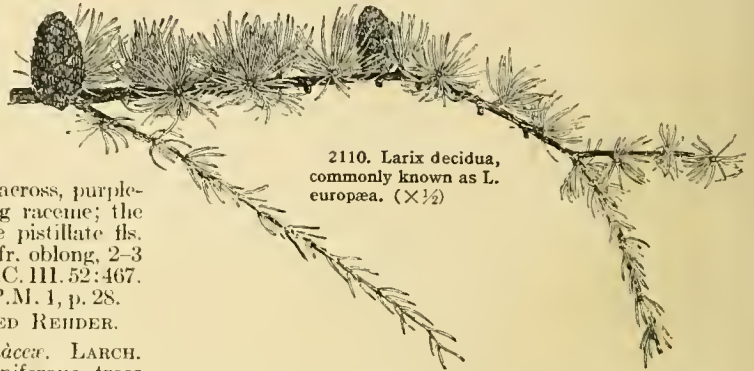
LĀRIX (ancient Latin name). *Pinæceæ*. LARCH. TAMARACK. Ornamental deciduous coniferous trees chiefly grown for their bright or light green foliage and regular habit.

Branches whorled, at least while young; lvs. linear, in crowded clusters on short spurs except on the leading shoots where they are spirally arranged; fls. monœcious; staminate fls. small, globose to oblong, solitary, consisting of numerous short-stalked, spirally arranged anthers; pistillate fls. larger, consisting of several or numerous scales, with 2 naked ovules at the base, each scale borne in the axil of a much longer bract: cone with woody, 2-seeded scales, persistent on the axis; seeds with large, thin wings, ripening the first year.—About 10 or 12 species in the colder regions and the high mountains of the northern hemisphere.

The larches are handsome trees of regular pyramidal habit, but in old age becoming sometimes irregular;

they are particularly handsome in spring with their light green tender foliage and studded with their usually bright purple pistillate flowers. They are all hardy North except the Himalayan *L. Griffithii*, and are often planted as park trees, chiefly for the light green foliage and the regular conical, or in some varieties pendulous, habit. The most beautiful is probably *L. leptolepis*, with the foliage turning bright yellow in fall, while the others assume only a pale yellow color. They are also very valuable forest trees, especially for the northern and mountainous regions; no forest tree goes farther north than the larch, reaching in North

America 67° and in Siberia 72° of latitude. The wood is hard, heavy and very durable, and much used for construction, that of *L. occidentalis* being considered the best of all American conifers. From the European larch turpentine is obtained. The bark contains tannin, and an extract is used for tanning leather. The larch grows in almost any kind of soil, including clay and limestone, and prefers a somewhat moist, but well-drained soil and an open situation; the American larch grows well even in swamps. Unfortunately several insects and fungi prey on the larch, and sometimes do considerable damage, especially the leaf-eating larvae of some moths. Propagation is usually by seeds sown in spring, and the young seedlings shaded; varieties are



2110. *Larix decidua*, commonly known as *L. europæa*. (X $\frac{1}{2}$)

grafted on seedlings, mostly on those of *L. decidua* (*L. europæa*), either outdoors by whip- or cleft-grafting or in the greenhouse by veneer-grafting; they may also be increased by cuttings of nearly ripened wood under glass or by layers, but this method is rarely practised.

A. Bracts longer than the scales: scales numerous, stiff, spreading or recurved after maturity.

occidentālis, Nutt. Fig. 2109 (adapted from Pacific R. R. Report). Tall tree, to 150 ft., with dark-colored bark, becoming bright cinnamon-red on older trunks, and with short, horizontal branches, forming a narrow pyramidal head: branchlets pubescent when young; lvs. rigid, sharply pointed, triangular, keeled beneath, 1-1 $\frac{3}{4}$ in. long, pale green: cone oblong, 1-1 $\frac{1}{2}$ in. long; scales orbicular, almost entire, tomentose beneath. Brit. Col. to Mont. and Ore. S.S. 12:594. G.F. 9:497. Gt. 20:685, figs. 8-10. G.C. II. 25:652. B.H. 22:8, figs. 3-5. B.M. 8253. R.H. 1909, pp. 252, 253.

AA. Bracts much shorter than scales.

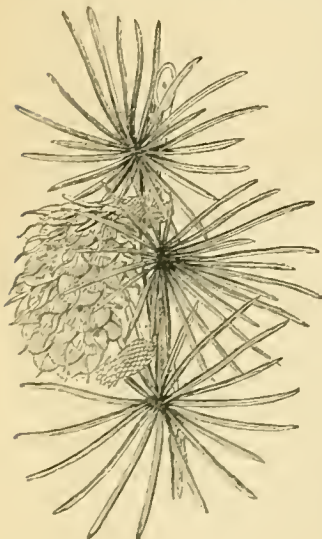
B. Lvs. with 2 white lines beneath: scales numerous, reflexed at the apex.

leptolepis, Murr. (*L. Kaempferi*, Sarg., not Carr. *L. japonica*, Carr.). Tree, to 80 ft., with horizontal branches, forming a pyramidal head: branchlets yellowish or reddish brown, glabrous and glossy; spurs short and globular; lvs. rather broad, obtuse, soft, $\frac{1}{2}$ -1 $\frac{1}{2}$ in., light or bluish green: cones ovate-oblong, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long, with emarginate, roundish ovate scales. Japan. S. I. F. 1:2. G.C. II. 19:88; III. 40:290. G.W. 8, p. 496. Gt. 20:685, fig. 5. B.H. 22:8, fig. 2.—The handsomest of the larches as a lawn tree. Var. *minor*, Murr. (var. *Murrayana*, Maxim. *L. japonica*, Murr., not Carr.). Dwarfier form with smaller cones. Gt. 20:685, fig. 2. B.H. 22:9, fig. 4. Var. *prostrata*, Beissn., a prostrate form.

BB. Lvs. without white lines, very narrow: scales erect-spreading, straight or slightly incurved at the apex.

C. Scales usually puberulous or finely tomentose, slightly incurved at the apex, numerous.

decidua, Mill. (*L. europæa*, DC. *L. lārix*, Kars-ten). EUROPEAN LARCH. Fig. 2110. Tree, to 100 ft.,



2109. *Larix occidentalis*. (X $\frac{2}{3}$)

with pyramidal, later often irregular, head: bark dark grayish brown: branchlets slender, glabrous, yellowish: lvs. compressed, triangular, soft and obtuse, bright green, $\frac{3}{4}$ – $1\frac{1}{4}$ in. long: pistillate fls. purplish: cones $\frac{3}{4}$ – $1\frac{1}{2}$ in. long, with many almost orbicular scales, usually puberulous, or glabrous on the back, loosely appressed at maturity. N. and Cent. Eu. F.E. 29:117. H.W. 1:3, pp. 108–112. M.D.G. 1908:316, 317. G.W. 9, p. 512. Gt. 20:684, fig. 3. B.H. 22:7, fig. 1. Var. *péndula*, Koch (*L. europæa* var. *péndula*, Lawson. *L. americana* var. *péndula*, Loud.). With pendulous branches; sometimes confounded with the American larch. Gt. 20:684, fig. 11. B.H. 22:8, fig. 1. Gn. 35, p. 245; 39, p. 84. Var. *fastigiata*, Koch (*L. europæa* var. *fastigiata*, Beissn.). Of columnar habit. Var. *virgata*, Hayek (*L. europæa* var. *virgata* Hempel & Wilhelm). Branches long and tortuous, very sparingly branched. M.D. 1905:10. H.W. 1, p. 113.—A hybrid of this and the preceding species has been received from Dunkeld, Scotland, and is now growing at the Arnold Arboretum. It is of vigorous growth, but has not yet produced cones.

sibírica, Ledeb. (*L. europæa* var. *sibírica*, Regel, and var. *rossica*, Regel). Tree, to 120 ft., with straight slender st. and rather short ascending branches: branchlets yellow: buds grayish brown and dark brown or nearly black at the base: lvs. linear, $1\frac{1}{2}$ in. long: pistillate fls. usually green, sometimes whitish or brownish: cones ovate-oblong, usually $1\frac{1}{2}$ in. long; scales fewer and larger than in the preceding species, finely tomentose on the back, half-spreading at maturity. N. E. Russia to Siberia. Gt. 20:684, figs. 1, 2. B.H. 22:7, figs. 2, 3.

cc. Scales glabrous, striate, straight at the apex, half-spreading at maturity, usually rather few.

laricina, Koch (*L. americana*, Michx. *L. microcarpa*, Desf. *L. péndula*, Salisb.). TAMARACK. HACKMATACK. Tree, to 60 ft., with horizontal branches, forming a narrow pyramidal head, sometimes broad and open on older trees; bark reddish brown: branchlets slender, glabrous, reddish yellow, often bloomy: buds reddish brown: lvs. like those of the former, but of light bluish green color: cones small, oval or almost globular, $\frac{1}{2}$ – $\frac{3}{4}$ in. long; scales few to 20, almost orbicular and entire, glabrous. Canada, south to Pa., west to Ill. and Manitoba. S.S. 12:593. Em. 106. Gt. 20:684, fig. 7, 8. B.H. 22:10, figs. 2, 3.

dahúrica, Turcz. (*L. Cajanderi*, Mayr). Tree, to 70 ft., of fairly regular habit while young, old trees usually irregular with wide-spreading branches: branchlets bloomy: buds yellowish brown, darker or nearly black at the base: lvs. linear, about $1\frac{1}{2}$ in. long: cones small, $\frac{3}{4}$ –1 in. long; scales orbicular or ovate, rounded or emarginate at the apex, lustrous, about 20 or more. E. Siberia. Gt. 20:684, figs. 9, 10. B.H. 22:9, figs. 5, 6. Var. *Principis Rupprechtii*, Rehd. & Wilson (*L. Principis Rupprechtii*, Mayr). Cones larger, to $1\frac{1}{2}$ in. long; scales more numerous, truncate at the apex; bracts at least on the lower part of the cone more than half as long as the scales. N. China. G.W. 10, p. 566.

L. chinensis, Beissn. = *L. Potaninii*. — *L. Griffithii*, Hook. f. & Thoms. Pyramidal tree, to 60 ft., with spreading and pendulous branches: lvs. soft, obtuse: cones 2–3 in. long, oblong, with exerted and reflexed bracts. Himalayas. F.S. 12:1267–68. R.H. 1868, p. 371. Gt. 20:685, figs. 1–4. B.H. 22:10, figs. 4–7. G.C. II, 25:719; 26:465; III, 41:130, 131. B.M. 8181. — *L. Kaempferi* Carr. = *Pseudolarix Kaempferi*. — *L. Kaempferi*, Sarg. = *L. leptolepis*. — *L. kurilensis*, Mayr (*L. dahurica japonica*, Regel). Allied to *L. leptolepis*, to 70 ft., branches wide spreading; young branchlets deep bluish red, puberulous: lvs. rigid: bracts as long or somewhat shorter than scales. N. Japan. S.I. F. 2:1. G.W. 6, p. 499 (habit). — *L. Lyallii*, Parl. Allied to *L. occidentalis*, but lower: young branchlets tomentose: lvs. quadrangular: young cones deep purple, the scales with fringed margin. Brit. Col. to Wash. S.S. 12:595. G.C. II, 25:653; III, 23:357. Gt. 20:685, figs. 11–13. B.H. 22:9, figs. 1–3. M.D.G. 1905:129 (habit). — *L. Masteriana*, Rehd. & Wilson. Allied to *L. Griffithii*. Tree, to 60 ft.: lvs. bright green, $\frac{3}{4}$ – $1\frac{1}{2}$ in. long: cones about $1\frac{1}{2}$ in. long: bracts long exerted and reflexed, gradually narrowed into a mucro. W. China. — *L. olgensis*, Henry.

Allied to *L. kurilensis*, but scales pubescent. Amurland. — *L. Potaninii*, Batal. (*L. chinensis*, Beissn. *L. tibetica*, Franch.). Allied to *L. occidentalis*. Tree, to 80 ft.: branchlets glabrous: lvs. acute or obtusish, about 1 in. long: cones oblong-ovate, 1–2 in. long: bracts lanceolate, exceeding the nearly orbicular scales; scales spreading at maturity. W. China. G.C. III, 39:178. — *L. tibetica*, Franch. = *L. Potaninii*.

ALFRED REHDER.

LARKSPUR: *Delphinium*.

LÀSIA (Greek, *rough* or *prickly*, referring to the aculeate caudex, scape and foliage). *Aracæ*. Two perennial herbs, woody at the base, allied to *Dracontium* and *Cyrtosperma*, not tuberous, with a more or less decumbent caudex, native in E. India, Ceylon, Java, Cochín-China. *L. spinosa*, Thwaites (*Dracontium spinosum*, Linn. *Pöthos spinosus*, Ham. *Lasia heterophylla*, *L. Zollingeri*, *L. Jenkinsii*, *L. Hermannii* and *L. desciscens*, Schott), is offered abroad. It is a glasshouse subject: caudex about $1\frac{1}{4}$ in. thick, prickly: petioles 9–18 in. or more long, prickly; blade variable in shape, hastate or entire, or deeply pedately pinnatifid: spathe 6–10 in. long, the upper part rolled into a tail-like extension, the open or spadix-bearing part short. E. India.

L. H. B.

LASIAGRÓSTIS: *Stipa*.

LASIÁNDRA: *Tibouchina*.

LASTHÈNIA (name of a woman who was a pupil of Plato). *Compósita*. Low, slightly succulent annuals, glabrous or only puberulent, with opposite lvs. and numerous inch-wide heads of yellow fls. in early summer: rays 5–15; receptacle conical or even subulate, with projecting points bearing the narrow flattened achenes; pappus none, or of 5–10 scales: involueral bracts making a bell-shaped or hemispherical cup.—Species about 6. Ore. and Calif., and Chile.

glabrata, Lindl. (*L. californica*, Lindl. *Hologymne glabrata*, Bartl.). Height about 1 ft.: lvs. linear or lanceolate, usually 1–4 in. long, some sheathing at base: peduncles long, somewhat enlarged below the erect head; pappus none. Calif. B.M. 3730. B.R. 1780, 1823.—The plant cult. under this name is likely to be *Bacria gracilis*, which see. In *Lasthenia* the bracts of the involucre are united to form a green cup with toothed border, while in *Bacria* the bracts are not united.

HARVEY MONROE HALL.

LASTRÈA (C. J. L. Delastre, Austrian botanist). *Polypodiææ*. A name commonly used in the trade, especially in England, for species of *Dryopteris*. Also spelled *Lastrea*. On the basis of priority it has no claim to recognition, as it was established by Bory in 1824, while we have *Nephrodium*, 1803; *Aspidium*, 1801; *Tectaria*, 1800; *Polystichum*, 1799, and *Dryopteris*, 1763.

The following additional species properly classified under *Dryopteris* (Vol. II, p. 1078) are in the American trade under the name *Lastrea* (the combinations are for *Dryopteris*, not *Lastrea*):

A. *Lowest pinna reduced to auricles: texture thin.*

sáncta, Kuntze. Lvs. 6–9 in. long, 1–2 in. wide on short slender stalks; lower pinnae very much reduced; under surface glandular. W. Indies.

palústris, Kuntze. Lvs. 2–3 ft. long, 8–12 in. wide, on long straw-colored stalks; lower pinnae reduced, the upper $\frac{3}{4}$ in. wide, cut down to the rachis into linear-oblong lobes. Brazil.

montana, Kuntze. Lvs. $1\frac{1}{2}$ –2 ft. long, 6–8 in. wide; lower pinnae greatly reduced to mere auricles; upper pinnae 1 in. wide, cut into close blunt lobes. Eu., N. Amer. A var. *cristato-gracile* is also cult.

AA. *Lower pinnae scarcely reduced: texture firm.*

rigida, Kuntze. Stalks stout, densely scaly; lf-blades $1\frac{1}{2}$ ft. long, 4–6 in. wide, oblong-lanceolate,

the lower pinnae not reduced; segms. with mucronate teeth. Eu. Var. *argûta* is native and wild in Calif., and is often considered a distinct species.

lépida, Moore. Lf.-blades $1\frac{1}{2}$ ft. long, 6-7 in. wide, ovate, bipinnatifid or bipinnate, the lower 4 or 5 pairs slightly smaller; indusia hairy. Of greenhouse origin.

Other species cult. under the name *Lastrea*, as *L. aristata* and *L. Richardsii*, belong to the genus *Polystichum*, which see.

L. M. UNDERWOOD.

R. C. BENEDICT.†

LATÂNIA (East Indian name). *Palmæceæ*. Tall, spineless palms, with solitary robust annular trunks. Leaves ample, terminal, long-petioled, suborbicular, palmately flabelliform, plicately multifid; segms. smooth or spiny on the margins; rachis short; petiole 3-sided, concave above; ligule shell-shaped; sheath short; spadices many feet long, compressed at the base and branches, sheathed with incomplete sheaths; staminate fld. branches cylindrical, digitately arranged at the ends of the branches, very densely clothed with imbricated bracts; pistillate portion somewhat twisted, few-fld., sheathed with very broad dentate bracts; staminate fls. in tiny pits and half-exserted beyond the bracts, the perianth smooth and shining; pistillate fls. larger; drupe globose, obovoid or pear-shaped, yellow.—Three species of fan palms from the Mascarene Isls. *L. borbonica* is one of the dozen commonest trade names among palms, but the seeds offered under this name are said to be almost invariably those of *Livistana chinensis*. *Latania borbonica* of the botanists is properly *Latania Commersonii*, which has 3-seeded frs., while those of *Livistana chinensis* are 1-seeded. Allied genera are discriminated under *Hyphæne*. G.C. II. 25:75.

Latantias are essentially warmhouse palms and require moderate shading through the greater part of the year, and also an abundance of water. A well-drained and rather light compost is most suitable for them, and if the soil at the time of repotting is of the same temperature as the house in which the plants are grown, there will be less risk of a check to the delicate rootlets. They should have a night temperature of not less than 60° to 65°. As they grow very freely, it is advantageous to plant out if possible. Propagate by imported seeds sown over strong bottom heat. Bone-meal is a good fertilizer for these palms. *L. Commersonii* is a particularly striking palm, the leaf-stems being quite long, smooth, and colored bright crimson, as are also the ribs of its fan-like leaves, this coloring being especially bright on the young foliage. *L. Loddigesii* is the strongest grower of the genus, the leafstalks reaching a length of about 8 feet, usually chocolate-colored and quite glaucous, the leaves thick and leathery and their ribs reddish while young, though never developing such bright tints as those of the preceding species. *L. Verschaffeltii* is also very attractive, though possibly a little more delicate than the other two, its leafstalks being long and rather slender, and orange-yellow in color, the ribs of the leaflets also yellow and the leaves themselves of a light shade of green. (W. H. Taplin.)

AA. *Lvs. glaucous*.

Loddigesii, Mart. (*L. glaucophylla*, Hort.). About 50 ft. in nature, cult. specimens 10-20 ft.; lvs. 3-5 ft. long, very glaucous, primary veins slightly tomentose beneath, tinged with red, especially in young plants; segms. 2 ft. long, less than 3 in. wide, unequally acuminate, the edges spiny in young plants; petioles 3-4½ ft. (or more) long, tomentose, entire in the mature, spiny in the young plant; spadix 3½-4 ft. long; drupe pear-shaped, 3-angled, 2½ in. long, 1¾ in. thick. Mauritius.

AA. *Lvs. not glaucous*.

B. *Petiole densely tomentose, with an orange margin*.

Verschaffeltii, Lem. (*L. aurea*, Duncan). Wild specimens 40 ft.; about half this in cult.; lvs. pale green, 4½-5 ft. long, the segms. 2½ ft. long, above 2 in. wide,

acuminate, the entire margins and veins slightly tomentose beneath; petioles 5-8 ft., densely tomentose, with entire, orange margins, spiny in young plants; spadix 4-8 ft. long; drupe slightly 3-angled, 2 in. long, 1½ in. wide. Isl. Rodriguez. I.H. 6:229. G.C. III. 31:152.

BB. *Petiole red, slightly tomentose*.

Commersonii, Gmel. (*L. rubra*, Jacq. *L. borbonica*, Lam., not Hort.). Lvs. 5-5½ ft. long, dark green above, paler beneath; segms. lanceolate, acuminate, 2 ft. long, 3¼-3½ in. wide, their margins entire, spiny in young plants, veins and margins tinged with red; petiole 4-6 ft., slightly tomentose, the margins smooth, spiny in young plants; spadix 3-6 ft. long; drupe globose, 1½-1¾ in. diam. Mauritius. Not A.F. 4:567 and 7:127, A.G. 13:141; 15:389 and 19:557, V. 9:199, G. 2:459, all of which are *Livistana chinensis*.

L. erecta and *L. variegata* are trade names. Any specimens in cult. will probably be found to be varieties of some of the above.

N. TAYLOR.†

LATHRÆA (*hidden*, Greek, alluding to habitat). *Orobanchæceæ*. TOOTHWORT. Root-parasites without green herbage, sometimes sown or encouraged in shrubberies where their host-plants grow.

Allied to *Orobanche*, but the calyx with 4 broad short teeth or lobes rather than with 2 or 4 pointed sepals, and the fls. not regular: low herbs, brownish, flesh-colored or bluish, bearing many small fls. in scaly racemes or spikes, the sts. usually simple and erect; stamens 4, in 2 pairs, with 2-celled anthers; caps. 1-celled, opening by 2 valves.—Species 5. Eu., Asia, Japan. In N. Amer., the family is represented by *Orobanche* (the broom-rape), *Conopholis* (squaw-root or cancer-root), *Epifagus* or *Leptanthium* (beech-drop), *Aphyllon* or *Thalesia*, Fig. 231, Vol. 1, by some united with *Orobanche*, and *Boschniakia* of the far Northwest. They are scarcely horticultural subjects, although some of the species seem to establish themselves readily when planted where there are proper hosts.

Two species are more or less recorded in horticultural literature. *L. Cladestina*, Linn. (*Cladestina rectiflora*, Lam.), Eu., has very many densely crowded sts. 4-6 in. high, from densely interlaced rhizomes; fls. pale gray-purple or violet, darker purple on the lower lip, 2 in. long and erect in racemes 3-5 in. high. Grows on willow and poplar, and other hosts. G.C. III. 35:292, 293, showing a group established on roots of beech and willow. G. 36:242. A showy species. *L. Squamaria*, Linn. (*Squamaria Orobanchæ*, Scop.), Great Britain to Russian Asia: pale rose-color, with flesh-colored or faintly bluish fls. which are streaked with purple or dark red; rootstock scaly, fleshy, creeping; fls. many, nodding, short-stalked or in a dense spike. On roots of hazel.

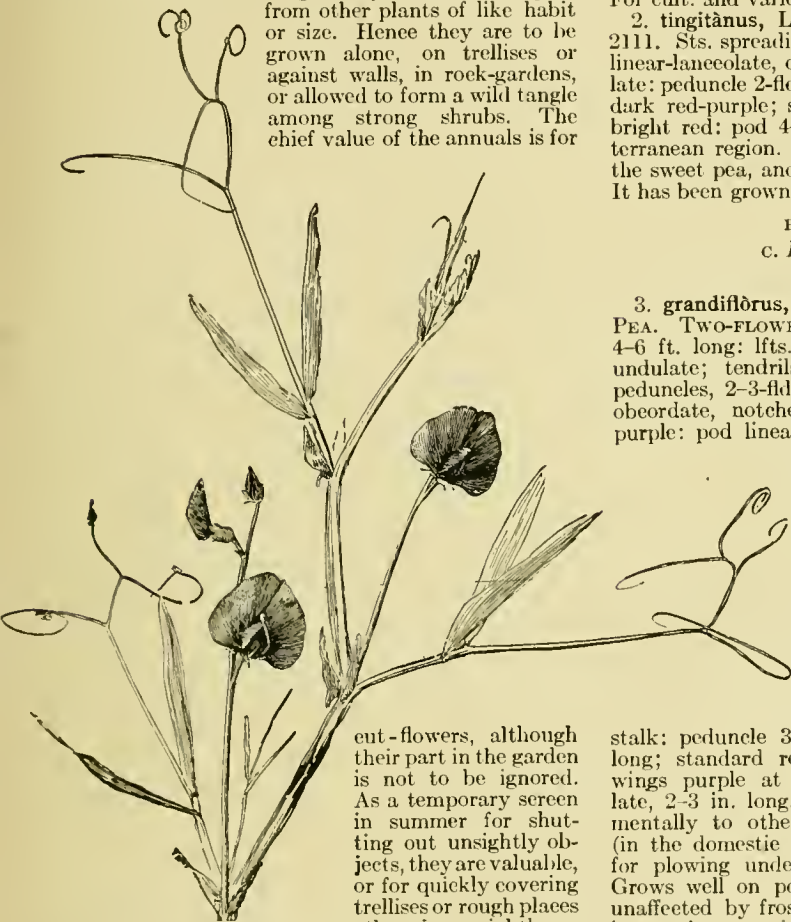
L. H. B.

LÁTHYRUS (name used by Theophrastus for some leguminous plant). *Leguminosæ*. Annual and perennial, climbing and upright herbs and shrubby plants with pinnate leaves, half-sagittate stipules and showy papilionaceous flowers.

Stems flat or winged, in some species: lvs. equally pinnate, ending in a tendril or in a point; lfts. 2 or several; stipules leafy, large and prominent, half-sagittate; fls. solitary or racemose, on long axillary peduncles; calyx oblique-campanulate, 5-parted, the upper teeth often shorter; corolla dark blue, violet, rose, white or yellow, or a union of these, the standard large, broadly obovate or roundish, notched, with a short claw, the wings falcate-obovate or oblong, the keel shorter than the wings, incurved, obtuse; stamens diadelphous (9 and 1) or monadelphous below; ovary 1-celled, the pod several-seeded; style curved, usually twisted, flattened, hairy along the inner side; pod flat or terete, 2-valved, dehiscent.—A genus according to the Index Kewensis, of more than 200 species, occurring in the northern hemisphere, Amer., Eu., Asia, and in Afr. and

S. Amer. *Orobis niger* and *O. vernus* are common garden names, but Bentham & Hooker, also Engler & Prantl, make *Orobis* a subgenus of *Lathyrus*, characterized in part by the lack of tendrils. See *Orobis*.

The genus is best known by the sweet pea. Most other forms are perennial, although some of these are cultivated as annuals. All are free-growing plants, so independent in their ways that they require a place to grow by themselves, apart from other plants of like habit or size. Hence they are to be grown alone, on trellises or against walls, in rock-gardens, or allowed to form a wild tangle among strong shrubs. The chief value of the annuals is for



2111. *Lathyrus tingitanus*. Sometimes sold as a form of sweet pea. $\times \frac{1}{3}$

ent-flowers, although their part in the garden is not to be ignored. As a temporary screen in summer for shutting out unsightly objects, they are valuable, or for quickly covering trellises or rough places otherwise unsightly.

The perennials are of comparatively easy cultivation, succeeding

in any garden soil. The annuals are more exacting in their requirements, demanding a moderately rich garden soil, abundant moisture, coolness and depth for their roots, and open sunlight. All are grown from seed, sown very early in the open to secure the required coolness for the roots. The perennials are propagated, in addition, by division, special varieties being increased by cuttings in the fall, after the flowering season, or in spring from old plants stored in the greenhouse. The roots of perennials are long and fleshy, and, when once established, usually continue for years without attention.

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A. Habit climbing: lvs. tendril-bearing. (*Lathyrus*.)

B. Plants annual: lfts. 1 pair.

1. *odoratus*, Linn. SWEET PEA. St. rough-hairy, winged: lfts., oval or oblong, mucronulate; stipules lanceolate: peduncle 2-4-flid., much longer than the lvs.; fls. in shades of blue, red, yellow and white, fragrant, the shield large and showy, expanded, sometimes "hooded;" pod 1-2 in. Summer. Italy. B.M. 60.—For cult. and varieties, see *Sweet Pea*.

2. *tingitanus*, Linn. TANGIER SCARLET PEA. Fig. 2111. Sts. spreading, winged, glabrous, 3 ft. long: lfts. linear-lanceolate, obtuse, mucronulate; stipules lanceolate: peduncle 2-flid., longer than the lvs.; fls. 1 in. long, dark red-purple; shield large, purple, wings and keel bright red; pod 4-5 in. long. June, July. W. Mediterranean region. B.M. 100.—An earlier annual than the sweet pea, and because of its vigor will run it out. It has been grown for forage.

BB. Plants perennial.

c. Lvs. with 1 pair of lfts.

d. Stipules narrow.

3. *grandiflorus*, Sibth. and Smith. EVERLASTING PEA. TWO-FLOWERED PEA. Fig. 2112. St. winged, 4-6 ft. long: lfts. large, ovate, obtuse, mucronulate, undulate; tendrils branched, short; stipules small: peduncles, 2-3-flid., longer than the lvs.; shield large, obovate, notched, broad, rose-purple, wings dark purple: pod linear, 3 in. June, July. S. Eu. B.M.

1938.—Larger vine than *L. latifolius*, but weaker and less rampant. Fls. as large as those of the sweet pea. Free-flowering, succeeding in any soil, not requiring much light. Adapted to banks, along path-margins in woods, among strong shrubs, and as a covering for rocks.

4. *sylvestris*, Linn. FLAT PEA. St. straggling or climbing, 3-5 ft. long, stout, winged, glabrous, with creeping rootstock: lfts. linear-lanceolate, thick, with winged lf-stalk: peduncle 3-6-flid., equaling the lvs.; fls. $\frac{1}{2}$ in. long; standard rose, with green spot on its back; wings purple at summit; keel greenish; pod lanceolate, 2-3 in. long. All summer. Eu.—Inferior ornamentally to other perennials; sometimes mentioned (in the domestic var. *Wagneri*) as a forage plant and for plowing under in a green state as a fertilizer. Grows well on poor, unimproved sandy soil, and is unaffected by frosts and droughts. For garden cult., it may be sown in a seed-bed and transplanted when of suitable size. Its seeds in the wild state are said to be to some degree unhealthy, but in the cult. form this quality has been bred out.

5. *rotundifolius*, Willd. PERSIAN EVERLASTING PEA. Low-growing, winged species: lfts. ovate; stipules toothed: peduncles many-flid., longer than the lvs.; fls. large, rose-pink. June. Russia and the East. B.M. 6522.—A species of easy cult. requiring a cool, shady and sheltered position. Adapted to stony banks.

6. *undulatus*, Boiss. (*L. Sibthorpii*, Baker). Sts. twining, broadly winged: lfts. oblong: peduncle 5-6-flid.; fls. a mauve-red.—A form intermediate between *L. latifolius* and *L. rotundifolius*. A somewhat tender species, said to be 6 weeks earlier than any other.

DD. Stipules broad.

7. *latifolius*, Linn. EVERLASTING PEA. PERENNIAL PEA. Fig. 2113. St. winged, 4-8 ft.: lfts. ovate-elliptic or ovate-lanceolate, somewhat glaucous, mucronate, 2-3 in. long; tendril branching: peduncle many-flid., longer than the lvs.; fls. rose, large; pod flat, 4-5 in. long. Aug. Woods of Eu.—This is the common perennial pea, and one of the hardiest and most easily cult.

species, thriving almost anywhere, even among flags and boulders. A rampant grower, it is a good trellis plant, and is adapted as a cover to wild, rough places, as a rock-garden, where it scrambles over bushes and stones. It succeeds in shade and grows rapidly, but, like all species of *Lathyrus*, it is impatient of removal, owing to the size and length of its roots. It is not



2112. *Lathyrus grandiflorus*. ($\times \frac{1}{2}$)

fragrant. Its varieties are not clearly defined. Var. *álbus*, Hort., the white form, is adapted to the same uses as the type, and is, besides, valuable to florists who want white fls. in midsummer. Var. *spléndens*, Hort., dark purple and red, is said to be the best form of the type, but does not come true from seed. There is a striped form, also. Other trade names are vars. *albiflorus*, *grandiflorus*, *grandiflorus álbus* and *magníficus* with large richly colored fls.

8. *magellánicus*, Lam. LORD ANSON'S BLUE. St. 3-5 ft. long, smooth, angled, somewhat branched: fls. ovate or oblong-linear; tendrils branched; stipules cordate-sagittate, broad; peduncles long, 3-4-fl.; fls. dark purple-blue. June, July. Straits of Magellan.—A strong-growing, woody, almost evergreen species covered with a bluish bloom. Since it is a maritime plant, salt is said to assist its growth. It is sometimes regarded as an annual. Var. *álbus*, Hort., "LORD ANSON'S WHITE," is the white form.

9. *pubéscens*, Hook. & Arn. A soft-hairy, diffusely-branching shrub: st. 4-angled; lvs. with rarely 2 pairs of fls., ending in a stout trifid tendril. Extra Trop. S. Amer. from Valparaiso to Chiloe in Chile. G. 32:499.

cc. Lvs. with more than 1 pair of fls.

10. *palústris*, Linn. MARSH PEA. WING-STEMMED WILD PEA. St. slender, 1-3 ft. long, glabrous or somewhat pubescent, often winged, rather erect: fls. 2-4 pairs, oblong-lanceolate, acute, 1-2 in. long; tendrils branched; stipules small, lanceolate: peduncles 2-8-fl., scarcely longer than the lvs.; fls. purplish, $\frac{1}{2}$ in. long; pod 2 in. long. Summer. N. N. Amer. and N. Eu., in moist places.—A good bog-plant. Var. *myrtifolius*, Gray (*L. myrtifolius*, Muhl.). MYRTLE-LEAVED MARSH-PEA. Has smaller, obtuse lvs., broader and larger stipules, the fls. pale purple. July, Aug. Banks of rivers, N. N. Amer. to N. C.

11. *marítimus*, Bigel. SEA OR SEASIDE PEA. BEACH PEA. St. stout, 1-2 ft. long, angled, decumbent: fls. 3-6 pairs, ovate-oblong, thick, glaucous, nearly blue, 1-2 in. long; stipules lf.-like, broadly ovate and cordate-hastate: peduncles 6-10-fl., a little shorter than the lvs.; fls. purple; wings and keel paler, $\frac{3}{4}$ in. long; pod $1\frac{1}{2}$ in. long, hairy. May-Aug. Gravelly and sandy seacoasts throughout northern hemisphere.—A spreading plant with creeping rootstock and of rapid growth, very tenacious of life. A good plant in rock-gardens and in gravelly soil.

12. *venósus*, Muhl. SHOWY WILD PEA. St. stout, 2-3 ft. long, finely pubescent, strongly 4-angled: fls. 4-6 pairs, oblong-ovate, obtuse, often pubescent below, 2 in. long; stipules narrow, short; peduncle

crowded, 8-16-fl., rather shorter than the lvs.; fls. purple, 6-8 lines long; pod smooth. June, July. Shady places and along streams, Canada to Ga.

13. *spléndens*, Kellogg. PRIDE OF CALIFORNIA. St. subshrubby, slender, more or less soft-pubescent: fls. 4-6, ovate-oblong to linear, $\frac{1}{2}$ -1 in. long, acute; stipules narrow: peduncle 6-12-fl.; fls. pale rose or violet, large. Dry hills of coast ranges, S. Calif. Gn. 52:162.—A greenhouse plant 1 ft. long or more, becoming 8-10 ft. at home, where it dies down during the summer. Elsewhere it adapts itself to climate but is not hardy in N. U. S. Sometimes confused with a variety of *L. latifolius*.

14. *violáceus*, Greene. Sts. slender, shrubby below, 4-8 ft. high, acutely angled: fls. about 12, elliptic, obtuse with reflexed tips: fls. in racemes, 10-14 in each, $\frac{3}{4}$ in. long; violet-blue, banner veined with darker veins.—One of the most beautiful of the California species, native of Los Angeles County.

15. *lætiflorus*, Greene. WILD PEA. Shrubby, 4-8 ft. tall: fls. of firm texture, elliptic-lanceolate: fls. 1 in. long, fragrant, white faintly flesh-colored, the banner obovate, veined with red. S. Calif.—Plant under bushes or on banks.

AA. *Habit not climbing: lvs. not tendril-bearing. (Orobis.)*

B. Fls. yellow.

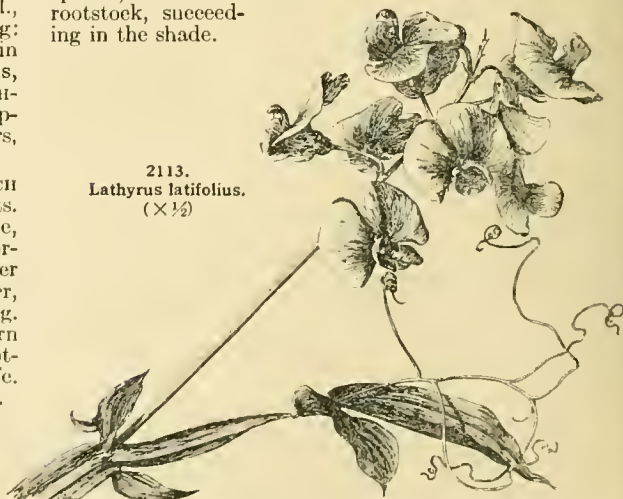
16. *montánus*, Bernh. (*Orobis luteus*, Linn. *L. luteus*, Baker). St. simple, angled, smooth: fls. 5-8 pairs, large, elliptic-lanceolate, pointed, glaucous below: peduncles many-fl., a little shorter than the lvs.; fls. large, orange-yellow. June, July. Forests of the Alps.—A shade-enduring species with fls. in erect, spike-like clusters and adapted to borders and rockeries.

BB. Fls. not yellow.

17. *polymórphus*, Nutt. PRAIRIE VETCHLING. St. rather stout, usually low, glabrous or finely pubescent, erect, a little woody at the base: fls. 3-6 pairs, scattered, narrowly oblong, acute, thick, 1-2 in. long; stipules narrowly acuminate: peduncle 2-6-fl., a little longer than the lvs.; fls. purple, large. March-July. Grassy, alluvial plains, Colo. to New Mex. and Ariz.

18. *niger*, Bernh. (*Orobis niger*, Linn.). BLACK PEA. BLACK BITTER VETCH. St. erect or ascending, branched, angled, 1-2 ft. long: fls. 6-8 pairs, elliptical or ovate, $\frac{1}{2}$ -1 in. long, light green, turning black when drying; stipules narrow, small: peduncles 6-8-fl., longer than the lvs.; fls. purple, small. June, July. Mountainous and rocky districts, Cent. Eu. B.M. 2261.—Slender species, with short rootstock, succeeding in the shade.

2113.
Lathyrus latifolius.
($\times \frac{1}{2}$)



19. *vérnus*, Bernh. (*Orobis vérnus*, Linn.). SPRING BITTER VETCH. St. simple, somewhat pubescent, 1-2 ft. long: lfts. 2-3 pairs, ovate-acuminate, light green; stipules entire; peduncles 5-7-fld., shorter than the lvs.; fls. blue-violet; keel shaded with green, nodding. May, June. Hills and woods, S. and Cent. Eu. B.M. 521.—A compact, tufted plant, growing quickly in sun or a little shade; best in deep, sandy loam, in a sheltered position; hardy. Var. *álbus*, a white form, is rare. Var. *fláccidus*, Ser. (*Orobis fláccidus*, Rad.) has very narrow flaccid lvs.

20. *ornátus*, Nutt. Fig. 2114. St. sometimes branched, glabrous, often glaucous: lfts. few pairs, lanceolate-linear, rigid and strongly veined; stipules entire; peduncles about 4-fld., longer than lvs.; fls. large, purple, very showy. Plains eastern base of Rocky Mts.

L. álbus, Linn. f. Root of clustered club-shaped fibers: lfts. 2-3 pairs, linear to lanceolate: fls. white or yellowish, standard sometimes purple, or rose on back. Eu.—*L. Cicera*, Linn., and *L. Ochrus*, DC., are annual forage plants.—*L. tuberósus*, Linn., has been imported. It differs from all described above by having tubers. It is a native of the northern parts of the Old World, and bears red fls. which are generally fewer and smaller than those of *L. sylvestris*.

A. PHELPS WYMAN.

JOHN W. HARSHBERGER. †

LAUREL. Properly *Laurus nobilis*, but other broad-leaved evergreens have taken the name. The kalmias are known as laurels. The cherry laurel is *Prunus Laurocerasus*, and in America *P. caroliniana*. Portugal laurel is *P. lusitanica*. Ground laurel is *Epigæa*.

LAURÈLIA (from *Laurus*, because of resemblance in leaves). *Monimiaceæ*. Aromatic forest trees, 2 in Chile and 1 in New Zeal.: lvs. coriaceous, opposite, mostly serrate: fls. in axillary cymes or racemes, dioecious or polygamous, apetalous; perianth or calyx of male fls. with a short tube and 5-12 lobes in 2 or 3 series, and 4-12 stamens; perianth of other fls. narrower-tubed and elongating after fertilization, 3-5-cleft, the stamens reduced to scales or the outer ones perfect; carpels numerous, with solitary erect ovules: achenes small, included in the perianth.

serràta, Bert. **HUANHUAN TREE.** Timber tree in southern parts of Chile, and hardy in parts of S. Ireland, to 70 ft., with fetid wood: lvs. broadly oblong-lanceolate or lanceolate, nearly or quite obtuse, glandular-serrate with open spreading teeth, bearing pellucid glands, aromatic: infl. axillary, cymose, simple or paniculate, the 8-parted perianth greenish yellow, the segms. equal; pedicels very short. B.M. 8279. G.C. III. 36:401 (as *L. aromatica*).

L. nòva-zealándia, A. Cunn. Tree, to 80 or 120 ft. high, and trunk 4-6 ft. diam., with radiating buttresses: lvs. to 3 in. long, oblong to obovate, coarsely and bluntly serrate: fls. in axillary racemes $\frac{1}{2}$ -1 in. long on silky pedicels: lvs. and young branches aromatic when bruised.—*L. sempérvirens*, Tul. (*L. aromatica*, Poir.). **CHILEAN LAUREL.** Lvs. undulate-serrate with appressed teeth: infl. longer than in *L. serrata* and lax, perianth-segms. differing or subequal, fertile stamens usually exceeding 4; pedicels exceeding the fls.

L. H. B.

LAURESTINUS: Popular name of *Viburnum Tinus*.

LAUROCÉRASUS: *Prunus*.

LAÛRUS (the ancient name). *Lauraceæ*. **LAUREL.** SWEET BAY. The laurel or sweet bay tree of the florists is the most universal of evergreen tub-plants.

Laurus gives name to the family *Lauraceæ*, which includes *Cinnamomum*, *Camphora*, *Persea*, *Sassafras*, *Lindera*, *Benzoin*, and other genera. Many species have been referred to *Laurus*, but with the exception of two, these species are now placed in other genera. These two are *L. nobilis*, Linn. (the subject of this sketch), and *L. canariensis*, Webb & Berth., of the Canary Isls. They are small trees, with stiff alternate simple lvs.: fls. diœcious or perfect, small and inconspicuous, in small axillary umbels which in bud are inclosed in a globose involucre; perianth with a short tube and a 4-parted limb; stamens 8-12 or more, and staminodia

often present (staminodia usually 4 in fertile fl.); ovary scarcely sunk in the receptacle, the style short: fr. a small berry.—*L. nobilis*, Linn., the sweet bay, has stiff, dull green, entire, alternate lvs. lanceolate or lance-oblong in shape: yellowish fls. in early spring: succulent, purple, cherry-like frs. It is native to the Medit. region, sometimes attaining a height of 40-60 ft., but rarely assuming a true tree-like form. As a cult. subject, it is grown as a small standard tree, with a close-sheared top. The lvs. are sometimes used in cookery and the making of confections, because of their pleasant aromatic flavor. The wreaths with which the heroes of antiquity were crowned were made of laurel lvs. It is the laurel of history and poetry. Many other trees are known as laurel because of the similarity of their lvs. The cherry laurel is *Prunus Laurocerasus*; the Portugal laurel, *Prunus lusitanica*; laurel of the



2114. *Lathyrus ornatus*. (×1)

southern states, *Prunus caroliniana*; the laurel, or mountain laurel of Calif. is *Umbellularia californica*. The *Laurus Benzoin* of trade catalogues is *Benzoin æstivale*; *L. Sassafras* is the sassafras tree; *L. Camphora* is the camphor tree (see *Cinnamomum*). It should be said that the bay rum of commerce is not made from the sweet bay, as some persons suppose, but from a pimenta.

The laurel endures abuse and neglect, the head can be trimmed to almost any shape, and the growth may be kept within small limits year after year. F.R. 1:669. (Fig. 2115.) It is, therefore, the most popular of plants for decoration of open-air or exposed restaurants, esplanades, architectural appurtenances, and the like. Although much used in America, it is still more popular in Europe. Of the European dealers one may order plants with heads trained to pyramids, cones, globes, and the like, and with bodies long or short. The plant will endure considerable frost. It is grown in the open in England: "The sweet bay bush in the farmer's or cottage garden comes with its story from the streams

of Greece, where it seeks moisture in a thirsty land along with the wild olive and the arbutus. And this sweet bay is the laurel of the poets, of the first and greatest of all poet and artist nations of the earth—the laurel sacred to Apollo, and used in many ways in his worship, as we may see on coins, and in many other things that remain to us of the great peoples of the past" (Gn. 47, pp. 301, 307). Although so universally used, there are few important horticultural varieties,—the variegated-leaved and crisped-leaved (the crimped-leaved being sometimes known as *L. regalis*) forms being the best known. There is also a willow-leaved form (known as *L. salicifolia*). Propagated by cuttings, and sometimes by seeds.

L. H. B.

Cultivation of bay trees. (H. A. Siebrecht.)

The sweet bay trees in their various trained forms of standard, globular, oval, conical and pyramidal shape, are almost indispensable in connection with the now prevailing architecture of our modern palaces of the Renaissance, Venetian, as well as Colonial and old English forms. Most of the leading architects require these formal and highly ornamental trees for the proper setting of their building designs.

Very few such trees, if any, are raised or cultivated in this country, for several reasons: First, because the climatic conditions for their rapid growth and development are far inferior to the climate of Belgium, which country produces nine-tenths of all these trees which are used in all shapes and forms; second, the higher labor cost and expenses to produce them in this country prohibit the cultivation and constant training.

It is estimated that several hundred thousand bay trees are sold every year in Europe and America. They are mostly imported from Belgium and Holland, where they are cultivated as follows: Cuttings 3 to 4 inches long from well-ripened wood are put in sharp sand, either under bell-glasses or in glass cases. Bottom heat is not essential. After the cuttings have rooted, they are placed in small pots, in fairly rich sandy loam, with good drainage, and can then be put in a hotbed, with gentle bottom heat, where they will at once make a good strong growth. After this they are planted, as a rule, in nursery rows, in rich sandy soil, with perfect drainage. They will make a strong shoot 3 to 5 feet in length in one season. These shoots are tied up to stakes. At the end of the growing season and long before the cold weather sets in, these young plants, together with their stakes, are taken up and put into their winter quarters, which usually is a well-lighted and ventilated shed—an ordinary barn-like shed, sometimes built several feet into the ground and provided with skylights and ventilators. These plants are set in close rows and watered once or twice a week, according to the weather. Little or no fire heat is used in these sheds unless the weather gets extremely cold. The temperature is kept just above freezing. In the spring they are taken out and either potted and plunged in nursery rows, or planted out, as before. Plenty of water, rich peaty soil and the congenial moist atmosphere near the seacoast induces them to make a fast and luxuriant growth. Thus they are cultivated continually until the plants have been trained into the desired form, and as soon as they have attained enough of this form to show their character, which usually is from five to six years after propagation, they are planted in properly proportioned hardwood tubs and are then ready for the

market, or to be further cultivated, perhaps for a good many years, until they grow into large specimens. The trees are cut back and trimmed into shape once a year, after the new growth is well matured.

The peaty muck soil in which they are grown abroad is very deceptive to Americans, and many fine trees have been ruined by not understanding its nature. Its dark color always makes it look moist. Sometimes when the soil looks moist enough the trees are really dying from drought.

In retubbing trees, there is danger of using for filling material a soil that is too heavy. The water then runs into the new soil, leaving the old soil dry. If the trouble is not detected soon the trees may be spoiled. The only thing to do in such cases is to comb out the old ball and cut back to live roots. The tree can then be planted in the open to gain a new set of roots, after which the top can be cut back to live wood. The tree may thus be eventually brought into a good shape again.

As a rule, bay trees are not good house plants. They do not like the dry heat of a dwelling. They can, however, stand considerable heat if they have plenty of fresh air and plenty of water. In spring and early summer, when they are making and finishing their growth,

they can stand any quantity of liquid manure or of strong manure mulching, for they are great feeders. The cured leaves of the sweet bay are used in putting up packages of rice, and impart a rich and agreeable aroma.



2115. *Laurus nobilis* in tubs.

LAVÁNDULA (Latin, *lavo*, to wash; referring to the use of lavender in the bath). *Labiatae*. This group includes the lavender (*L. vera*), an ancient garden favorite because of its pleasant odor.

Perennial herbs, subshrubs or shrubs; lvs. commonly crowded at the base, pinnatifid or dissected; whorls 2–10-fl., crowded into long-peduncled cylindrical spikes, which are unbranched or branched from the base; fls. blue, violet or lilac; calyx tubular, 13–15-ribbed, 5-toothed; corolla-lobes nearly equal, or the posterior lip 2-cut, the anterior

3-cut; stamens 1, didynamous, declined, included in the tube; style shortly 2-cut at the apex.—Species upward of 20, Canary Is. to India. In the N., winter protection should be provided for lavender. The plants of this genus grow naturally in dry and hilly wastes, except *L. multifida* which is found growing in peat.

A. Spike loose: upper floral lvs. fertile, shorter than the calyx.

B. Lvs. not densely woolly.

vèra, DC. (*L. angustifolia*, Moench). LAVENDER. Subshrub, 1–3 ft. high: lvs. oblong-linear or lanceolate, entire; younger ones often clustered in the axils, white-tomentose, revolute at the margins; older ones greener, 1–1½ in. long; spikes interrupted; whorls 6–10-fl. Summer. Perhaps a form of *L. Spica*. Var. *compacta*, Hort. (var. *compacta nana*, Hort.). Compact form: larger, deeper-colored fls., blooming 3 weeks earlier than type; 9 in. Rock-garden or border.

Spica, Cav. Dwarfier than the true lavender, whiter, the lvs. more crowded at the base of the branches, spike denser and shorter. The floral lvs. are lanceolate or linear (rhomboid-ovate acuminate in *L. vera*) and the bracts are linear-awl-shaped, shorter than the calyx, while in *L. vera* the bracts are almost absent. Medit. region.

BB. *Lvs. densely woolly.*

lanàta, Boiss. Differs also from the preceding in having much longer and less crowded spikes. Spain. It grows 1-2 ft. high and needs winter protection in N. J.

AA. *Spike dense: upper floral lvs. sterile, comose.*

B. *Lvs. entire.*

Stœchas, Linn. Shrub, 2-3 ft. high: lvs. tomentose, about $\frac{1}{2}$ in. long: spikes short-peduncled, densely comose; fls. dark purple. Medit. region. Cult. in S. Calif.

BB. *Lvs. pinnate-dentate.*

dentàta, Linn. Lvs. pubescent: spikes long-peduncled; fls. deep purple. Medit. region. B.M. 400.—Intro. 1900 by Franceschi.

multifida, Linn. CUT-LEAVED LAVENDER. Herbaceous biennial, evergreen, 1-2 ft. high: lower lvs. petioled, upper sessile; lfts. decussately pinnatifid, hoary: spike simple, square, spiral: fl.-lvs. ovate, nerved, villous: fls. lilac. Calabria and Canary Isls.—Prop. by seed. Summer to fall. Not widely cult. Offered in S. Calif.

WILHELM MILLER.

A. C. HOTTES.†

Cultivation of lavender. (M. G. Kains.)

In the eastern United States, lavender is grown in but few gardens, but in California, where climatic and soil conditions seem favorable, it is more commonly planted, although not on a commercial scale. The dry soil of that state and the light limestone soil of the Black Belt of Alabama and adjacent states seem to be most inviting to this industry.

The generic name is derived from the ancient use of its flowers and leaves in bath perfumery. The flowers long retain their strong fragrant odor after drying, and upon distillation yield a lemon-yellow very fluid oil of aromatic, bitterish, burning taste. Though this is officially credited with stimulant and tonic properties, it is seldom administered in the pure state. Its chief uses are in the manufacture of perfumery, aromatic vinegar and lavender water, an alcoholic solution of the oil and other odorous substances. For these purposes, English oil has long commanded the highest price, but recently the French product has been claimed superior. Though all parts of the plant are aromatic, and both leaves and flower-stems are used in oil manufacture, oil obtained in the first half hour of distillation from flowers alone is much superior to the later distillate and also to the oil obtained from a mixture of flowers and stems. These grades, and also the highly valued product of very dry seasons, are always sold separately.

Lavender is best propagated by cuttings of one season's growth taken with a heel of older wood, in late autumn or early spring. When set 3 to 4 inches asunder in rather moist soil and shaded, they strike more readily and produce more symmetrical plants than older wood. Seed does not propagate desired varieties, and division is not advised, since plants so obtained are more susceptible to disease than those made from young-wood cuttings. After danger of frost, the one-year-old plants are set 4 feet asunder in rows 6 feet apart, running north and south. Closer planting and the hedge-method yield a smaller quantity of bloom. Dry, light, calcareous, even stony soils upon sites where sun and air are unimpeded by trees, favor this plant. Upon such fewer are injured by frost, and the oil is of superior quality. In moist soil so much water enters the plant as to enfeeble it, and upon rich lands yield and quality both suffer. Light fertilizing with stable-manure or ashes turned under in autumn, and spring harrowing, are advised. During the first year in the field the plants should be clipped to prevent flowering and to encourage stockiness. Vigorous plants so treated may grow to a height and a diameter of 5 feet, and when two to four years old produce secondary bloom-spikes after the general

harvest, which usually occurs in early August. Plantations should be destroyed when four to six years old and the land rested with other crops before setting to lavender again. Cutting in clear weather, in early blossom, before the dew is off and at once distilling give best results; but no delay should occur. Cutting in wet weather, in the heat of the day, holding blossoms long before distilling and exposing them to the sun after cutting result in serious losses. One pound of flowers yields from one-half to one drachm of oil, and an acre from two to twenty-five pounds. The annual output of the stills of Grasse, France, is from 80,000 to 100,000 kilogrammes.

"Oil of spike," obtained from a broad-leaved, much whiter and smaller species (*L. Spica*), is less fragrant



2116. *Lavatera trimestris*. ($\times \frac{1}{2}$)

than true lavender oil, being analogous to oil of turpentine, with which it is often adulterated. It suggests the odor of rancid coconut oil. Officially, it is credited with carminative and stimulant properties, and has been found useful in nervous languor and headache. It is used by artists in the manufacture of varnishes, by porcelain painters, and to a small extent in perfumery, mainly as an adulterant. From 20,000 to 25,000 kilogrammes are annually produced at Grasse. See also "Culinary Herbs" by M. G. Kains, 1912.

LAVÁNGA (from the Bengal name). Sometimes written *Lavunga*. *Ruticææ*, tribe *Citrcæ*. LAVANGALATA. Climbing shrubs, distantly related to the orange.

Leaves alternate, trifoliate, with long wingless petioles; lfts. with motile petiolules; spines axillary, strong, recurved: fls. in axillary clusters, 4-5-merous; stamens twice as many as the petals; anthers linear; ovary 3-, 4- or 5-celled with 2 superposed ovules in each cell; fr. oval or oblong, resinous within (without pulp vesicles) and having a thick oily lemon-like peel.—Several species are known, occurring in India, the Malayan Archipelago and Cochin-China. These plants

should be intro. into the U. S. for trial as stocks for citrous frs., and for use in breeding experiments. The name is commonly spelled Lavunga, but appears as Lavanga in the original publication.

scândens, Buch.-Ham. (*Limonia scândens*, Roxbg.). Climbing shrubs with fragrant white fls. and yellowish resinous frs. the size of a pigeon's egg. This strong-growing scandent shrub occurs in India and the Malayan peninsula.

WALTER T. SWINGLE.

LAVATERA (one of the Lavater family of Zurich, at the time of Tournefort). *Malvaceæ*. Flower-garden annuals and biennials, and some ornamental shrubs, the taller known as tree mallows.

Herbs, shrubs and trees, tomentose or hairy: lvs.



2117. *Lavatera insularis*. ($\times \frac{1}{2}$)

angled or lobed, sometimes maple-like; fls. sometimes 2-4 in. across, variously colored, rarely yellow, solitary in the axils or borne in terminal racemes; column of stamens divided at the summit into an indefinite number of filaments; petals 5; ovaries few to many, united about an axis which is conical or umbrella-shaped at top; fl.-bractlets 3-6 or 9, joined into an involucre.—Species about 25, mostly in the Medit. region, but extending to the Canaries, Asia, Austral., and the islands off S. and Lower Calif.

These plants are of the easiest culture, the first species being the commonest, and all propagated by seeds. There seem to be no double forms.

A. Plant annual, herbaceous.

triméstris, Linn. (*L. rosea*, Medikus). Fig. 2116. Height 3-6 ft.: lvs. nearly glabrous, upper ones angled; fls. rosy, 4 in. across: receptacle or axis of the fr. expanded at the apex into a disk, inclosing the ovary.

Medit. region. B.M. 109. Gn. 24, p. 89; 51, p. 212; 53:62; 61, p. 180; 65, p. 351. Gn. W. 23:363. Var. *alba*, Hort., has white fls. Var. *spléndens*, Hort., is an improved garden strain. Gn. 73, p. 314. G. 33:141.—This species is an excellent flower-garden subject, of the easiest cult., usually growing 2-3 ft. in height and blooming summer and autumn, with attractive rose-pink or red fls.

AA. Plant biennial, woody at the base.

arborea, Linn. With annual flowering branches, forming a shrub 3-10 ft. high or less: lvs. 5-9-lobed, softly downy on both sides, rarely nearly glabrous: fls. pale purple-red, about 2 in. across: receptacle small, marked with little pits, not exerted. Eu. Cult. in the form of var. *variegata*, which has mottled lvs. Gn. 23, p. 114. G.Z. 28, p. 49. V. 8:99.

AAA. Plant perennial, shrubby or even tree-like.

B. Fls. 1-4 in the axils, pedicelled.

assurgentiflora, Kellogg. Shrubby, 6-15 ft. high: lvs. glabrous or sparingly stellate-pubescent, 5-7-lobed, 3-6 in. wide: fls. purple; petals 1-1½ in. long, with long, narrow, glabrous claws, and a pair of dense, hairy tufts at the base: axis of the fr. low-conical, about as long as the carpels. S. Calif. Isls.—It makes a strong, round-headed shrub, with large red fls., and is one of the best plants to stand saline winds. Used extensively as a windbreak for vegetable-gardens about San Francisco, and is common in old yards throughout Calif., and has been suggested for forage; very resistant to drought. From seed it will reach 6 ft. or more and will bloom within a year.

BB. Fls. solitary, sessile.

Ólbia, Linn. Perennial, shrubby, about 6 ft. high: hairs of the st. pilose, somewhat clustered, distant: lvs. softly tomentose, lower ones 5-lobed, upper 3-lobed, highest oblong, scarcely divided: fls. reddish purple. S. Eu. G. 36:733.—Cult. in England, where it occasionally sows itself.

BBB. Fls. solitary, stalked.

insularis, Wats. Fig. 2117. Low bush, cinerous-puberulent, with 7-lobed obtusely dentate lvs.: fls. on pedicels shorter than themselves, yellowish white striped and tipped with purple, the petals long-spatulate and emarginate; bractlets spatulate, almost distinct: fr. of about 10 carpels, in an enlarged calyx. Coronados Isls., near S. Calif. G.F. 9:165 (reduced in Fig. 2117).—Probably not cult. outside amateurs' collections in S. Calif.

WILHELM MILLER.

LAVENDER: *Lavandula*.

L. H. B.†

LAVENDER COTTON: *Santolina Chamæcyparissus*.

LAWN: *Landscape Gardening*, pp. 1816-1818.

LAWSONIA (John Lawson, who published, in 1709, an account of his travels in North Carolina; see page 1505). *Lythraceæ*. **HENNA**. Shrubs, grown in Florida and southern California for ornament.

Sometimes becoming arborescent, 6-25 ft., glabrous, the branches more or less spinescent: lvs. opposite, lanceolate, attenuate into a petiole or a narrow base, entire, acute: fls. 4-merous, rather small, in terminal panicle cymes; calyx-tube very short or none, the lobes 4; petals 4, ovate, wrinkled, on the top of the calyx-tube; stamens usually 8, exerted, sometimes only 4 and sometimes 12; ovary 4-celled, with a long style and a capitate stigma: caps. globose, exerted beyond calyx.—One variable species as defined by Koehne (Engler's Pflanzenreich, hft. 17, 1903).

inermis, Linn. A handsome shrub with many very fragrant fls. Var. *alba*, Hassk. (*L. alba*, Lam.) has white

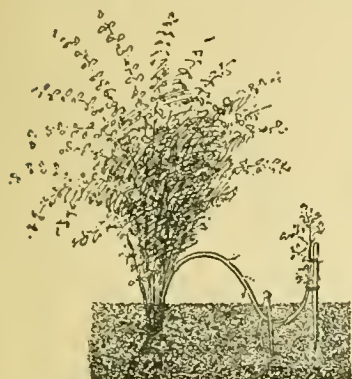
fls.; otherwise they are rose, an *L. rubra* is listed, and var. *miniata*, Hassk., is cinnabar-red. Widely cult. in tropical countries, but probably native in N. Afr., to W. and S. Asia; naturalized in W. Indies, where it is known as "mignonette." Its lvs. produce the henna or

TREES AND SHRUBS . .

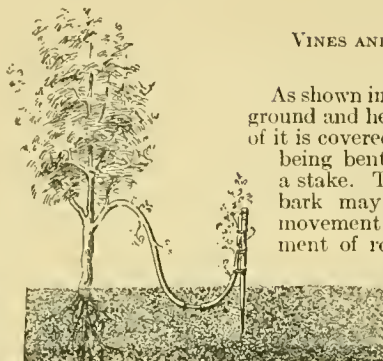
{ Bowed branch—
Bark ruptured.
Bark ringed.
Tongue cut.
Tip layered.
Mound- or stool-layer.
Potted or aerial layer.

VINES AND CANES . .

{ Simple layer.
Trench layer.
Serpentine layer.



2118. A layer notched at the bottom.



2119. A layer ringed or girdled at the bottom.

alhenna of the Arabs (eyprus of the ancients), a yellow dye which is used in Egypt and elsewhere by women to color their nails, and by men to dye their beards, and for other similar uses. It is also known in W. Indies as "Egyptian privet," and sometimes as "reseda." It is the camphire of the authorized version of the Bible.

L. H. B.

LAYERS, Propagation by. A layer is a stem that is made to take root while still attached to the parent plant. The whole subject of propagating plants by means of layers is known as *layerage*; the actual operation or practice is *layering*.

The tendency, under favorable conditions, to produce roots from the cambium zone of some part of the stem is manifested by many plants, especially in the tropics. It may be noticed in the species of *ficus* cultivated in the greenhouse, in *epigaea* and *Rhus Toxicodendron* in the woods, in tomato vines in the garden, in grape-canvies lying on the ground, and frequently in young apple trees when the trunk becomes covered with earth to an unusual depth. With most such plants, rooting by detached parts is easily accomplished, and this being more convenient, layering is usually practised only with those plants that do not root readily from cuttings.

The mode of root-production is essentially the same whether the part is a layer or a cutting. The proper conditions as to moisture, temperature, food-supply, seem to stimulate the formation of one or more growing points in the cambium zone. The multiplying cells

force their way through the bark, and if favorable soil contact is secured, supporting roots are soon developed. It is when the food supply is deficient or the cell action is so slow that the detached part will perish before supporting roots



2120. Mound- or stool-layering.

can be established, that rooting while the parts are still attached to the parent plant and nourished by it need be employed.

The different methods of layering are matters of detail adapted to the varying plants to be dealt with. Usually branches are chosen of rather young wood, which can easily be brought under the soil and which, when rooted, can be removed without damage to the old plant. The most favorable season is usually the spring or time of most rapid cell-growth. The methods of layering may be represented in the following diagram:

As shown in Fig. 2118, a suitable branch is bent to the ground and held in place by a forked pin, so that a part of it is covered with 2 or 3 inches of rich earth, the end being bent to an upright position and fastened to a stake. The bend and consequent rupture of the bark may be all that is needed to obstruct the movement of food-material and cause the development of roots at this point. If not, a tongue may be cut not deeper than one-third the thickness of the branch from below upwards and near a bud or node. In Fig. 2119 a layered branch is shown with a ring of bark removed, a good practice with thick hard-barked species.

For many low-branched shrubs, mound- or stool-layers are prepared (Fig. 2120), as follows: In the spring, head the bush back to a series of stubs, which will produce a large number of vigorous young shoots. By midsummer, in some cases, or the following spring, a mound of earth is thrown around the old stool and the base of the new shoots, and from these latter abundant rooting is secured, so that by the following autumn or spring they may be separated and set in nursery rows. Dwarf apple stocks, and English gooseberries, are propagated extensively by means of mound-layers.

When a branch cannot be brought to the ground, sometimes the earth is brought to the branch by clasping the halves of a broken or specially made pot around a tongued or girdled branch. The receptacle is filled with earth and sphagnum moss to retain the moisture; or the moss may be held in place by a cone of strong paper (Fig. 2121). It may be necessary to support the pot with a light stand of stakes. Where a moist atmosphere is retained, as in a conservatory, merely a ball of sphagnum bound around the branch with twine will serve an equally good purpose with less trouble. This kind of propagation is known as air-layering, Chinese layering or circumposition.



2121. Air-layering.

In the case of vines, a cane may be laid horizontally in a shallow trench, covering a few inches to induce rooting, and leaving a node or two exposed for growth, and so on to the end, as shown by Fig. 2122. After young shoots are well started from the uncovered buds, the earth may be filled in to the level of the ground line.

In Fig. 2123 is shown what is often called the serpentine layer, in which the cane is bent, parts being covered and the intervals left above the ground. It is held that by this means the tendency of the sap to flow to the extremity and there make the strongest growth, is overcome, and even rooting secured the whole length of the cane. This method is often used with quick-growing vines like clematis and wistaria, from which it is possible to secure a succession of layers from the annual growth in spring and early summer.

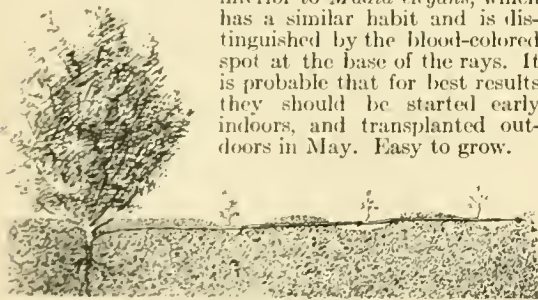
The "tips" of black raspberries are layers of a special kind. In this case, the cane bends over and takes root at its end, thereby providing a natural means of propagation. Many plants produce stolons, or shoots springing from the crown and having a strong tendency to take root at joints or tip; this attribute is sometimes indicated in the name of the plant, as *Cornus stolonifera*.

All of the foregoing operations are more readily successful in the more moist situations; more successful in the nearly saturated atmosphere of the southern states, for instance, than in the comparatively dry conditions of the prairie states.

S. C. MASON.

LÀYIA (Thomas Lay, naturalist in the Beechey voyage). *Compósita*. Annual herbs with yellow or white flowers in spring or early summer.

Leaves chiefly alternate, all entire or some, particularly the lower, pinnately toothed or lobed; fls. about 1-1½ in. across, and the rays distinctly 3-toothed; ray-fls. 8-20; disk-fls. fertile, their tubular corollas 5-toothed.—About 13 W. American species. The species described below are diffuse, much-branched and about a foot high. For general cult. they are probably inferior to *Madia elegans*, which has a similar habit and is distinguished by the blood-colored spot at the base of the rays. It is probable that for best results they should be started early indoors, and transplanted outdoors in May. Easy to grow.



2122. A horizontal multiple layer.

A. Rays entirely white.

glandulôsa, Hook & Arn. **WHITE DAISY**. One-half to 2 ft. tall, the st. hispid, sometimes glandular: lvs. 1-1½ in. long, 2-3 lines broad, linear, the upper ones all entire; rays 8-13, white or sometimes tinged with rose. B.M. 6856. Brit. Col and Idaho to Mex.—Cultivated in California and very desirable on account of its pure white rays.

AA. Rays yellow, sometimes tipped white.

B. Plants hairy.

élegans, Torr. & Gray. **TINY TIPS**. All the upper lvs. entire; rays 10-12, yellow, rarely white-tipped; pappus white or whitish, its copious villous hairs much shorter than the awn-shaped bristles, which are long plumose below the middle. This and the next have a few small, scattered, stalked glands which are wanting from the last two. Calif. Gn. 31, p. 465. G. 30:567. G.W. 17:

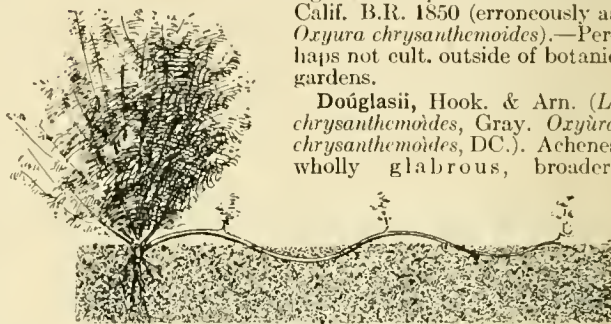
464.—Perhaps the best of the genus. Var. **álba**, Hort., is a pure white form.

platyglôssa, Gray. **TINY TIPS**. Some of the upper lvs. pinnatifid; rays light yellow, commonly white-tipped; pappus of stout, awn-like bristles which are upwardly scabrous. Calif. B.M. 3719.

BB. Plants not hairy or at most minutely pubescent.

Calliglôssa, Gray (*Calliglôssa Douglasii*, Hook & Arn.). Achenes villous-pubescent or partly glabrate; rays yellow, white-tipped; pappus of 10-18 very unequal and rigid awl-shaped awns. Central Calif. B.R. 1850 (erroneously as *Oxyura chrysanthmoides*).—Perhaps not cult. outside of botanic gardens.

Douglasii, Hook. & Arn. (*L. chrysanthmoides*, Gray. *Oxyura chrysanthmoides*, DC.). Achenes wholly glabrous, broader:



2123. Serpentine layering.

pappus none. Fls. yellow, only the tips of the rays white. A confused species.

L. guillardoides, Hook. & Arn. Branching rather freely, hispid, 8 in. or more high; heads rather large; rays orange-yellow. G.C. III. 32:61.

N. TAYLOR.†

LEAD PLANT: *Amorpha canescens*.

LEADWORT: *Plumbago*.

LEATHER FLOWER: *Clematis Viorna*. **L. Jacket:** *Eucalyptus punctata*. **L. Leaf:** *Chamaelaphne*. **L. Wood:** *Dirca palustris*; also *Cyrilla*.

LEBIDIERÓPSIS (Greek; like *Lebidiera*, a related genus now included in *Cleistanthus*). *Euphorbiaceæ*. The genus contains but 1 species, a tree once catalogued in S. Fla., probably not now in cult. in Amer. Lvs. alternate, simple, entire; fls. small, in axillary clusters; calyx of staminate fls. valvate; petals small; stamens 5, filaments united; ovules 2 in each of the 3 cells of the ovary; seeds globose, cotyledons thick and flat.

orbiculâris, Muell. Arg. (*Cleistanthus collinus*, Benth.). Lvs. 1½-4 in. long, 1½-3 in. wide, leathery, broadly ovate or elliptic, tip rounded or retuse, glaucous beneath, 5-8 pairs of nerves; fls. silky, 3-6 in a cluster; petals fleshy, narrow; seeds 2 lines thick, chestnut-brown. India.—Variable in lf.-form and hairiness.

J. B. S. NORTON.

LÈCYTHIS (Greek for an oil-jar, from the shape of frs.). *Lecythidaceæ*. One of a group of interesting Trop. American genera, comprising *Couropita*, *Grias*, *Japaraandiba*, *Bertholletia*. The species of *Lecythis* are shrubs or trees, one or two of which have been grown under glass abroad for their showy red fls. *L. Zabucajo*, Aubl., yields the excellent sapucaya nuts, resembling Brazil-nuts and superior to them. *L. Ollaria*, Linn., the monkey-pot, yields a regular urn-shaped fr. or box with a lid or cover. *Lecythis* is of perhaps 40 species, of the habit of *Couropita* but fls. smaller, in Trop. S. Amer.: lvs. alternate, coriaceous, entire or serrate; fls. usually large, in panicles or racemes; calyx with a turbinate tube and 4 or 6 segms.; petals usually 6, sometimes 4, nearly equal; stamens many, united in a hood-shaped body with the fertile anthers beneath; fr. leathery or woody, odd, globose or cup-shaped or urn-shaped with an operculum; seeds few, often large. None of the species seems to be of horticultural importance within our range.

LEDENBERGIA (von Ladenberg, misspelled in making the name). *Phytolaccææ*. A twining subshrub from Trop. Amer., allied to *Rivina*, with ornamental foliage: lvs. simple, entire, alternate, slender-stalked, ovate or elliptic-ovate: fls. small and whitish, in long axillary peduncled racemes, on very slender pedicels, perfect; perianth 4-parted, the segms. linear-oblong or linear-obovate and obtuse, enlarging in fr.; stamens 12: fr. a small achene. The plant in cult. is *L. roseo-antæa*, Lem. (*L. purpurea*, Hort.?), which is *Trichostigma peruvianum*. The single species of *Ledenbergia* is *L. sequieroides*, Klotzsch, of the Antilles and S. Amer., which is a slender-branched shrub with elliptic acuminate alternate lvs. and many small greenish fls. in long drooping very slender racemes. Apparently not in the trade.

LÈDUM (*ledon*, ancient Greek name of *Cistus*). *Ericææ*. LABRADOR TEA. Ornamental shrubs grown for their handsome white flowers and evergreen foliage.

Leaves alternate, short-petioled, entire: fls. rather small, $\frac{1}{3}$ – $\frac{1}{2}$ in. across, long-pedicelled, in terminal, umbel-like racemes; calyx-lobes and petals 5, spreading; stamens 5–10: caps. nodding, 5-celled, separating from the base into 5 valves, with many minute seeds.—Four species in the arctic and cold regions of the northern hemisphere, all found in N. Amer. One of the few ericaceous genera with polypetalous fls. The lvs. contain a volatile oil, with narcotic properties; the lvs. of *L. granlandicum* are said to have been used during the War of Independence as a substitute for tea, hence the name "Labrador tea."

These plants are low, sometimes procumbent, shrubs with evergreen narrow leaves fragrant when bruised, and with handsome white flowers appearing in early summer. They are all hardy North, and well adapted for borders of evergreen shrubberies or for planting in swampy situations. They thrive as well in sunny as in partly shaded situations, and prefer a moist, sandy and peaty soil. Transplanting is easy, if the plants are moved with a sufficient ball of earth. Propagation is by seeds sown in spring in sandy peat and treated like those of azalea and rhododendron, the young plants growing but slowly; increased also by layers and division.

palustre, Linn. WILD ROSEMARY. One to 2 ft. high: lvs. linear or linear-oblong, revolute at the margin, dark green and somewhat rugose above, densely ferruginous-tomentose beneath like the young branches, $\frac{1}{2}$ – $1\frac{1}{2}$ in. long: stamens usually 10: caps. ovate. May, June. Northern hemisphere, in N. Amer., from Newfoundland to Alaska. L.B.C. 6:560. Var. *dilatatum*, Gray. Lvs. broader, sometimes glabrescent and glaucous below: caps. more oblong. Amurland, Japan. Var. *decumbens*, Ait. (*L. decumbens*, Lodd.). With procumbent sts. and shorter lvs. N. E. N. Amer. B.B. (ed. 2) 2:677.

grœnlandicum, Oeder (*L. latifolium*, Ait). LABRADOR TEA. One to 3 ft., similar to the former, but lvs. broader, ovate to narrow-oblong, 1–2 in. long, tomentum beneath often rather pale at first: stamens 5–7: caps. oblong. May, June. Canada to Brit. Col., south to Pa. and Wis. L.B.C. 6:534 and 11:1049 (as *L. canadense*). J.H. III. 31:20 (as *L. palustre*). Gn. 34, p. 31. M.D.G. 1906:74 (habit). G. 35:349.

L. burifolium, Berg=*Leiophyllum buxifolium*.—*L. columbianum*, Piper. To 3 ft.: lvs. glabrous and glandular below, revolute: stamens 5–7: caps. oblong, acutish. Wash., Ore.—*L. glandulosum*, Nutt. Shrub, to 6 ft.: lvs. oblong or oval, glabrous, glaucous and glandular beneath, not revolute: stamens 10: caps. oval, obtuse. July, Aug. Brit. Col. to Calif. B.M. 7610.—*L. Lyonii*, listed abroad, is undeterminable. It is described as "a lovely shrub for rock-garden, very pretty in bud."

ALFRED REHDER.

LEËA (James Lee, Scotch nurseryman, 1715–1795). *Vitææ*. Tropical small trees or shrubs, some of which are cultivated as young plants in warm conservatories for their colored foliage and stately habit.

Leaves alternate, 1–3 times pinnate or simple, the petiole dilated at base; lfts. entire or serrate; tendrils none: fls. small or large, red, yellow or green, in cymes opposite the lvs.; calyx 5-toothed; petals 5, connate at the base and joined with the tube of stamens; ovary 3–6-celled; cells 1-ovuled: fr. a berry, mostly succulent, nearly globose but flattened at the top.—Species about 65, in tropics of Afr., Asia, Austral. and Pacific. *Vitis* differs in having the climbing habit, ovary 2-celled; cells 2-ovuled. The first species mentioned seems to be valued particularly for its fls.: the others are foliage plants which are presumably distinct horticulturally, but two of them may not be good botanical species, and cannot be distinguished without a knowledge of the fls.

Leeas are tropical house plants. *L. amabilis* has beautiful silvery vine-like foliage. It makes a handsome plant for pillar-posts, and does exceedingly well planted out; but it should be given a season of rest in winter by a partial drying out, when it will lose most, if not all, its foliage. This practice should be followed in any case. It may also be grown as a trained specimen in pots. Peaty soil is often recommended, but good light loam, with plenty of drainage, does equally well. (T. D. Hatfield.)

A. Foliage green.

coccinea, Planch. Lvs. 3-pinnate; lfts. 5 on each main division of the lf., oblong-lanceolate, dentate, margin recurved: fls. 60 or more in a trichotomous, flat-topped cluster about 3 in. across, scarlet in bud, the 5 spreading lobes of the corolla pink above; stamens yellow, exserted, each fl. about $\frac{1}{2}$ in. across. Burma. B.M. 5299.—It begins to flower when only a foot high, but the main stalk of the clusters is only an inch or so long.

AA. Foliage colored or variegated.

B. Lvs. marked bright red; veins white.

Micholitzii, Sander. Intro. by Sander & Co., 1899, from New Guinea: st. slender: lvs. pinnate, sometimes gigantic, arching; lfts. deeply serrate and undulate, rich green strongly marked with bright red and with white veins on the young lvs.

amabilis, Veitch. Lvs. pinnate; lfts. 5 or 7, lanceolate, acuminate, serrate, upper surface velvety, deep bronzy green, with a broad white stripe; veins white at the bases; young lvs. pale pinkish brown. Borneo. G.C. II. 17:493. Gn. 21, p. 352. J.H. III. 43:253. G.Z. 27, p. 145. Var. **splendens**, Lind., is marked with bright red and has a red st.; very attractive. I.H. 31:518.

BB. Lvs. flushed bronze; veins rosy.

sambucina, Willd. (*L. Rahrstiana*, Sander.). Lvs. pinnate or 3-pinnate, very large (often 4 ft. long); lfts. $6\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. wide, oblong, cordate at the base, acuminate, coarsely crenate. India, Malaya, Philippines, Trop. Austral. A very variable species. The above synonymy is the judgment of M. T. Masters in G.C. III. 23:245. F.E. 10:554. A.F. 13:1284. Gng. 6:278. A.G. 21:97.

Other leeas may be expected in the choice collections of amateurs, but these plants appear to be little known in the trade. *L. macrocarpa*, Laut. & Schumann, "with broad lfts.," is a recent introduction.

WILHELM MILLER.

LEEK (*Allium Porrum*), a flat-leaved, bulbous, hardy biennial, is probably a native of the Mediterranean region, where, particularly in Egypt, it has been used for culinary and medicinal purposes since prehistoric time. All parts of the plant possess an offensive pungent odor and acrid taste due to an essential oil also characteristic of its close relative, the onion. In medicine, the bulb, like the onion, is used as a renal stimulant. The blanched stems and leaves are much employed in continental cookery as a flavoring for soups, stews, and so on, boiled and served like asparagus, and in the raw state.

except in the larger cities and among our foreign population, the leek is little used in America.

Leek, though of the onion family, is differently treated and used. The object in its cultivation is to develop the leaves in such a manner that they become

numerous; the flower-stem does not appear before the second year, hence the necessity of growing it to full size the first year.

Sow the seed in March in a seed-bed (with slight bottom heat), in drills 2 or 3 inches apart; when large enough, thin out to stand 1 inch apart in the row, as they may attain the thickness of a fair-sized straw. In May or early June the seedlings are transplanted in the open ground; they are then cut half-way down and should also be set deep, so they will begin blanching when they attain a fair size. The soil best suited is a rich, moist, light loam; prior to the transplanting it should be well prepared with well-rotted stable manure,

if possible. The plants are generally set in drills 12 to 15 inches apart, and 6 to 9 inches apart in the drills. Shortening both roots and stems is often advised. As the plants grow, the soil should be drawn loosely around the stems and lower leaves to insure blanching. They should be well cultivated, and when growing freely should be earthed up slightly with the hand-cultivator or hand-hoe. Some of the successful gardeners still cultivate them on the celery-trenching system; by this means they can be watered more thoroughly and will attain a much larger size; also can be conveniently left in the trench with slight protection, and taken therefrom for winter use. Care must be taken not to cover too early, as they decay easily, beginning at the end of the foliage; this destroys the appearance. The hardier kinds used for this purpose will blanch yellow down to the so-called stem, which is white to the root. Leeks planted out in May are ready for use in September; the sowings can be made earlier and later to suit the time of maturing, and can be sown in August and September in coldframes and wintered over with slight protection, then transplanted to the open ground in April. The varieties best known to American gardeners

are London Flag, Large Musselburgh or Scotch Flag, Giant Carentan, and Large Rouen.

When blanching leeks are not desired, the plants may be cultivated like onions; indeed, except for earthing up, the cultural methods employed for these two crops are identical. Leeks

are marketed in bunches like young onions and, for winter use, are stored like celery. As a second crop to follow early cabbage, spinach, and the like, they are in general favor with market-gardeners. In soups and stews the rank odor disappears, leaving a mild and agreeable flavor. M. G. KAINS and J. OTTO THILLOW.

LEGUMES. The popular name given to the important group of plants included in the general Order Leguminosae comprises the herbs, shrubs, vines, and trees of the mimosa family (Mimosaceae), the senna family (Caesalpinaceae), the krameria family (Krameriaceae), and the pea family (Fabaceae; also called Papilionaceae or Phaseolaceae). In all, more than 7,000 species of plants are represented here, chiefly herbaceous in character; the arboreal forms occur in the temperate zones and are very frequent in the tropics. Many species are of unusual agricultural importance, both for forage, as cover-crops and green manure, and also for furnishing food for man. Among these may be noted alfalfa (*Medicago sativa*), beans (*Phaseolus* sp.), clover, (*Trifolium* sp.), vetch (*Vicia* sp.), and peas (*Pisum* sp.).

Most of the native species of legumes, and all those cultivated as farm crops, belong to the Fabaceae or pea family. In these species the flower is of the pea type (Fig. 2124). The upper larger petal, called the banner, *s*, is exterior and folded over the others in the bud. The two lateral ones, situated below the banner, are the wings, *w, w*, while the lower pair, which are sometimes united, form the keel, *k*. The keel incloses the stamens and pistil, the latter being often bent at right angles to the ovary, or coiled. The stamens are either free or they form a tubular sheath surrounding the ovary. Often the upper one alone is free, leaving a slit along the upper side of the sheath (Fig. 2125). These flowers are often dependent on insects for pollination.

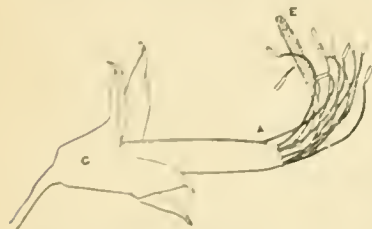
The fruit of the legumes is a pod or legume, as in the bean (Fig. 2126). As a rule, the pods are one-loculed, and have the seeds arranged in rows.

In some tribes they become several-celled by partitions which arise between the seeds. These pods become constricted at the partitions, and at maturity separate into short joints (see Fig. 1244, Vol. II). The valves of the pods are generally papery or leathery, and open at maturity, often by a sudden snapping of the valves, which scatters the seeds. In other tribes, however, the pods are indehiscent, or do not split at maturity (Fig. 2128).

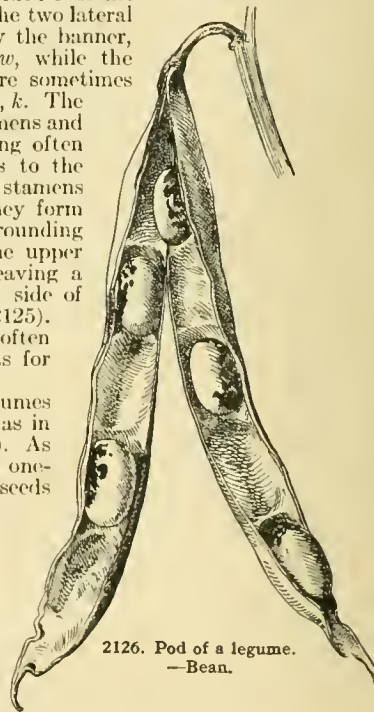
The use of leguminous crops for soil improvement has long been recognized by good farmers as desirable. Aside from the general benefits of crop-rotation, the actual soil-enrichment is due largely to an accumulation of available nitrogen, and this gain in nitrogen is caused by the presence of minute soil-bacteria which possess the power of growing on the roots of the legumes, and then utilizing or "fixing" the free nitrogen of the air and converting it into food for succeeding crops.



2124. Flowers of sweet pea, to show structure of a leguminous flower. Banner, standard or vexillum at *s*; wings at *w*; keel at *k*.



2125. Essential organs of a sweet pea flower. Calyx at *c*; tenth stamen at *a*, stigma at *e*.



2126. Pod of a legume.
—Bean.

In view of these facts, it is evident that for the most successful growth of alfalfa, clover, vetch, and other legume crops, the proper organisms should be abundantly present in the soil. Certain localities are so supplied, as, for example, southern regions, which contain the cowpea organism naturally, and sections of the Middle West, which usually are inoculated with alfalfa organisms. Introducing new kinds of leguminous crops into a locality requires the introduction also of the proper bacteria for the legume selected, and this is best accomplished by either of the following methods of artificial inoculation:

When a field is known to be well inoculated for a certain legume crop—for example, alfalfa—as indicated by the presence of numerous nodules upon the roots of alfalfa plants growing therein, such soil is very desirable for the inoculation of other fields on the

same farm or on nearby farms upon which alfalfa is to be sown for the first time. Two hundred pounds or more of sifted field-soil are sufficient for an acre. Transferring field-soil from any considerable distance is, however, expensive and subject to the danger of introducing troublesome weeds, insects, and plant diseases.

Another method is that of seed-inoculation by means of pure cultures. For many years the United States Department of Agriculture has cultivated and distributed liquid pure cultures of the bacteria beneficial to legume crops, and commercial organizations have produced and sold various types of cultures with more or less successful results. The seeds to be treated are placed in a clean bucket, pail, or tub and a pure culture of these beneficial bacteria is applied a little at a time, thoroughly stirring the seeds in order to form a thin, moist coating of the culture on every seed.

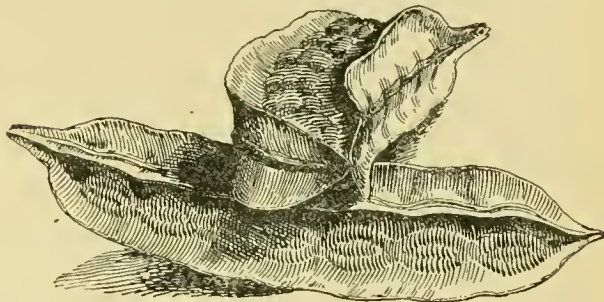
A comparison of the nitrogen-fixing nodules found upon the roots of different plants is interesting. The nodules are in reality roots or rootlets which, because of the presence of the nitrogen-fixing bacteria within their cells, have developed abnormally to form the characteristic swollen root tubercles or nitrogen-gathering nodules instead of the ordinary form of root (Fig. 2127). It is to be expected, as each kind of plant has a slightly different root-development, that the root-nodules will develop in a correspondingly typical manner. In fact, the nitrogen-fixing root-nodule of any kind of plant is almost as definite and characteristic for that plant as the shape of the leaves or the arrangement of the leaves on the stem. KARL F. KELLERMAN.

LEIOCHILUS: *Oncidium*.

LEIOPHYLLUM (from *leios*, smooth and *phyllon*; referring to the smooth foliage). Syn., *Dendrium*, *Ammýrsine*. *Ericaceæ*. SAND MYRTLE. Ornamental shrubs grown for their handsome evergreen foli-

age and the profusely produced small white flowers, although not much grown.

Densely branched shrubs, low and sometimes pro-umbent: lvs. opposite or alternate, crowded, small, short-petioled, entire; fls. in terminal, umbelliform corymbs; sepals and petals 5; stamens 10; anther-cells opening lengthwise; disk 10-lobed: fr. a 2-5-celled



2128. An indehiscent or slowly dehiscent leguminous pod—*Daubentonia*.

dehiscent many-seeded caps.—One species in E. N. Amer. from N. J. to Fla.; allied to *Ledum*, but the anther-cells opening lengthwise.

The sand myrtles resemble in appearance somewhat the dwarf box and are quite handsome when studded late in spring with the numerous umbels of small white or pinkish flowers. They are hardy or nearly hardy North and well adapted for borders of evergreen shrubberies and also for rockeries. They thrive best in a peaty or very sandy, loamy soil and as well in a sunny as in a partly shaded position. Propagated by seeds sown in pans and placed in a cool frame or by layers put down in fall.

buxifolium, Ell. (*Lèdum buxifolium*, Berg. *Déndrium buxifolium*, Desv.). Fig. 2129. Dense, leafy bush, to 3 ft. high: lvs. short-petioled, thick, oval or obovate, $\frac{1}{3}$ – $\frac{1}{2}$ in. long; fls. white, pinkish outside, about $\frac{1}{2}$ in. across, on slender pedicels; petals elliptic, almost twice as long as sepals; stamens usually twice as long as petals: caps. about thrice as long as sepals. April–June. Pine-barrens and mountains, N. J. to Fla. B.M. 6752. Gn. 42, p. 559. B.R. 531. L.B.C. 1:52 (as *Ledum*). Var. *Hügeri*, Schneid. (*Déndrium Hügeri*, Small). Lvs. alternate, $\frac{1}{3}$ – $\frac{1}{2}$ in. long; stamens about as long as petals: caps. about twice as long as sepals. High mountains of N. C. Var. *prostratum*, Gray (*Déndrium prostratum*, Small). Forming dense depressed tufts: lvs. usually oval, and deep green, very small, mostly opposite. High mountains of N. C. and Tenn.

ALFRED REHDER.

LEITNERIA (after Leitner, a German naturalist, killed in Fla. during the Seminole war). *Leitneriaceæ*. CORK WOOD. A small tree or shrub, the only representative of the family which is most nearly related to the *Myricaceæ* and *Salicaceæ*; sparingly branched, the sts. swollen at the base, spreading by suckers: lvs. alternate, entire, rather large, without stipules; fls. dioecious in axillary catkins before the lvs.; staminate



2129. *Leiophyllum buxifolium*. ($\times \frac{1}{2}$)



2127. Nodules on the roots of a young plant of garden pea.

fls. without perianth, with 3-12 stamens; pistillate consisting of a short-stalked pubescent ovary with small gland-fringed scales at the base; style slender; fr. an oblong pointed compressed, 1-seeded drupe.—One species in Fla. and Texas to S. Mo. The exceedingly light wood is occasionally used for the floats of fishing-nets. Hardly as far north as Mass.; it grows best in peaty, humid or swampy soil. Prop. readily by suckers which are freely produced in established plants. *L. floridana*, Chapm. Occasionally to 20 ft.; lvs. elliptic-lanceolate to lanceolate, acute or acuminate, pubescent below, 1-6 in. long; staminate catkins 1 1/4 in. long; pistillate smaller and slenderer; frs. 1-4, 3/4 in. long. S. S. 7:330, H. I. 11:1011. Rep. Mo. Bot. Gard. 6:30 H.—The plant has no claim to ornamental qualities, but is botanically interesting.

ALFRED REIDER.

LEMAIREOCÈREUS (Lemaire's *Cereus*). *Cactacea*. Usually large trees or shrubs (one species prostrate).

Stems and branches strongly ribbed and with numerous stout spines; fls. diurnal, medium-sized; fr. covered with clusters of spines (finally falling off as the fr. ripens), edible.—Species 13. This is one of the most important genera of the *Cereus* group. Some, and perhaps all, species are of great economic value; some are widely planted in the tropics for their delicious fr. Some 8 species are in cult.

A. Plants prostrate; fls. yellow.

eruca, Brit. & Rose (*Cereus eruca*, Brandegee). Stout, usually simple sts. prostrate, radiating from a center, dying at one end and advancing at the other, rooting on the under surface, 3-7 in. diam., densely armed with spines; fls. 4-5 in. long, with a slender tube, reported to be yellow; fr. globular, 2 in. diam., somewhat spiny. Common on the sandy plains of S. Low. Calif.—Of very peculiar habit, suggesting large caterpillars creeping along over the ground. This is especially noticed from the way they pass over obstructions or the bodies of other individuals. First the head or growing end is raised up over the object and passes down on the other side; then, by the dying back at the rear, the plant finally seems to have actually passed over the obstruction. This cactus is usually planted wrong in collections since most gardeners insist on placing it erect in a pot; but as it is constantly dying at base, it must sooner or later die. It ought to be laid flat at one end of a long box and allowed to creep toward the other end. There seems to be no record of this species having flowered in cult.

AA. Plants usually tall and erect.

B. Areoles with brown wool, more or less glandular.

C. Ribs 12-15.

Thúrberi, Brit. & Rose (*Cereus Thúrberi*, Engelm.). Several sts. arising from the same root, becoming 10-15 ft. high; ribs 13-16, very slightly prominent; spines 7-16, slender and rigid; fls. greenish white; fr. globose, 1-3 in. diam. S. W. Ariz. southward throughout Low. Calif., and to Sinaloa.

CC. Ribs 6-8.

queretarénsis, Brit. & Rose (*Cereus queretarénsis*, Web.). Arboresecent, with a trunk about 3 ft. high by about 11 in. diam.; the much-branched crown has a diam. of 12-16 ft., the total height of a plant being about 20 ft.; branches dark green, in young growth frequently of a peculiar violet-brown; ribs 6-7, separated by sharp grooves, which later become much flattened, and the sts. consequently more cylindrical; areoles depressed, dark brown; radial spines 6-9, the lower ones longest, about 1 1/4 in. long; centrals 1 (often but 2), reaching 1 1/2 in.; fls. numerous from the upper part of the branches, about 4-5 in. long; fr. yellow to red, about 2 in. long, covered with dark yellow to brown spines, about 1 in. long, and bulbous at the base. Mex.

III. Areoles with gray wool, not at all glandular.

C. The areoles of the ovary and fl.-tube bearing long flat bristles along with the spines.

stellatus, Brit. & Rose (*Cereus stellatus*, Pfeiff.). Stout, with few upright branches, 10-15 ft. high; ribs 7-15; areoles 1/2-1 in. apart; radial spines 8-10; centrals 3-5; fls. from near the ends of the branches, about 2 in. long, light pink; fr. globular, 1 1/2 in. diam., covered with clusters of deciduous spines, edible.—Sold in markets of S. Mex. Rare in collections; often confused with *Rathbunia sonorensis* and *L. Treleasei*.

CC. The areoles of the ovary and fl.-tube not bearing long bristles.

D. Fls. long and slender.

gummösus, Brit. & Rose (*Cereus Cuméngi*, Web. *C. gummösus*, Engelm. *C. gummösus*, Hort.). More or less branched, at first erect, then clambering or with some of the branches procumbent; ribs 7-9; spines rigid, 15 or 20; fls. purple, 4-5 in. long; fr. spiny, scarlet, slightly acid, edible. Common in Low. Calif.—This species does not grow easily in hothouses nor does it flower readily. It is a very important fr. to the poor of Low. Calif.

DD. Fls. rather short.

E. Areoles very close together, often running together.

Dumortieri, Brit. & Rose (*Cereus Dumortieri*, Salm-Dyck). Often large tree with a trunk 2 ft. diam. and hundreds of upright branches; branches strongly 6-angled; areoles closely set; spines numerous, needle-like, the longer ones 1 1/2 in. long; fls. small for the genus, 2 in. or less long, white. Cent. Mex.—Usually only small plants seen in cult.

EE. Areoles more distant.

griseus, Brit. & Rose (*Cereus griseus*, Haw. *C. chárneus*, Salm-Dyck). Tall tree, 25 ft. or more high, more or less branched; ribs 7-12, broad; spines 10-15; fls. purplish; fr. globular, covered with deciduous clusters of spines, edible.—Commonly cult. in Trop. Amer. for its frs. It is especially highly prized in Mex.

Wéberi, Brit. & Rose (*Cereus Wéberi*, Coulter. *Cereus candelà-brun*, Web.). Trees, 30 ft. or more high, with a regular candelabra form of branching, containing hundreds of erect branches; spines stout, 10 or more on a cluster; fls. lateral, white, about 5 in. long; fr. unknown.—This species, although not the tallest, is probably the largest in the whole cactus family. It is found in the hot valleys of S. Mex. where it literally forms forests. The fr. is not well known and the relationship is still uncertain. J. N. ROSE.

LEMBÓTROPIS NÍGRICANS: *Cytisus nigricans*.

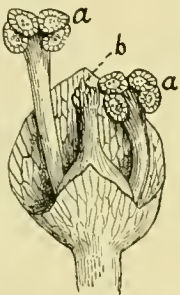
LEMNA (old Greek name, probably referring to the swampy habitat). *Lemnaceae*. DUCKWEED. DUCK'S-MEAT. Minute floating plants, like fragments of green, often found in standing pools and sometimes introduced into aquaria and lawn basins.

The Lemnaceae comprises the minutest of flowering plants, some 30 species in 4 genera: *Lemna*, *Spirodela*, *Wolffia*, *Wolffiella*. They are widely distributed in temperate, subtropical and tropical regions. They often cover the water of



2130. Duckweeds,
Lemna minor.
(Much enlarged)

ponds with a mantle of green. The lemnas and spirodelas are most useful because larger and more conspicuous than the wolffias. They are easily gathered for schoolroom and home aquaria, and may be procured from specialists in aquatics and native plants. Ducks and some fish eat these plants. One of the common duckweeds is shown 6 times its natural size in Fig. 2130. The lemnas are without any distinct stls., a whole plant commonly consisting of 1 miniature fl. and 1 unbranched root which has no vascular tissue. These lvs. are called fronds by the botanist. The plants grow separately, or cohere by their edges in 2's or 3's, and multiply by similar fronds, which grow out of the edges of the old ones something like buds. The fls. are minute and appear on the edge of the frond. They consist apparently of a pistil and 2 stamens which are inclosed in a sheath, which botanists have determined is a spathe by reason of the place where it is borne and by homology with related plants. Botanists now consider the 2 stamens as 2 fls. and the pistil a third fl. *L. minor* is said to flower more frequently than any other northern species. Details of its fl. are shown in Fig. 2131, where there seem to be 4 anthers, but there are only 2, each bearing 2 locules. Duckweeds are perennial plants. In the autumn they fall to the bottom of the ditch or pond, but rise again in the spring, and increase in size. The allied genus *Wolffia* contains the smallest flowering plants. There are about 10 or a dozen species of duckweeds, widely scattered. *L. polyrhiza* is now known as *Spirodela polyrhiza*, but *Spirodela* is considered by Bentham and Hooker a subgenus of *Lemna*. The common duckweed occasionally infests the small lily ponds (artificial ones), where it is a pest. The simple remedy is to flush the pond and see that common goldfish or carp are in sufficient numbers to clear off the remainder.



2131. Floral details of *Lemna minor*. *aa*, stamens; *b*, pistil. (Enlarged)

A. Veins 7-11; roots several (*Spirodela*.)

S. polyrhiza, Schl. Fronds broadly obovate or orbicular, attaining 3 or 4 lines diam., palmately nerved. Common in U. S.

AA. Veins 1-5; root solitary. (*Lemna*.)

B. Fronds oblong, 6 lines long, 3 lines wide.

L. trisulca, Linn. Fronds thin, narrow and minutely toothed at one end, thicker and stalk-like at the other, usually with 2 young ones growing from opposite sides near the base. V. 3:200.—Common in U. S.

BB. Fronds broadly ovate or orbicular, 2 lines long.

L. minor, Linn. Figs. 2130, 2131. Fronds usually cohering in 3's or 4's, rather thick, not minutely toothed, 1-2½ lines long. V. 3:200.

Other species of *Lemna* are native in N. Amer. Of *Wolffia* there are also a few species and of *Wolffiella* one. The wolffias are seldom collected for lawn ponds.

WILHELM MILLER.

LEMON (*Citrus Limonia*). Prior to 1894, the culture of the lemon in Florida was an industry of considerable importance. An annual output of 140,000 boxes had been reached, but the cold of 1894-1895 injured the trees and marked the beginning of the end of commercial lemon-production in the state for the time at least. Another contributing cause to the extinction of the industry was the development of anthracnose, a fungous disease causing brown spots on the fruit, particularly during curing and after shipment. The nature and control of this disease was not then understood. By 1901-1902 the crop had fallen to only a little over 1,000 boxes. Since 1894, the citrus industry of Florida has

moved southward. In consequence, regions have been opened up, which because of their more favorable location are very free from the blighting effects of cold. There is now a very noticeable awakening of interest in lemon-culture and it would not be surprising if the next ten to twenty years would see the industry once more established in the state. The outlook is further improved by the great advancement made in methods of orchard-heating and the control of the disease above mentioned.

Great care must needs be exercised in the selection of locations for growing lemons. The trees respond readily to increased temperatures and hence are too often in poor condition to withstand the low temperatures which often follow. Particular attention must be given to air-drainage and water-protection. Plantings of some size have been made in the last two or three years and still larger ones are contemplated.

The favorite variety and practically the only one planted is *Villa Franca*. It has proved to be materially harder than other varieties such as *Genoa* and *Eureka*. The *Rough lemon*, a variety of uncertain relationship, grows as a wild or semi-wild tree in southern parts of Florida. Occasionally the fruit finds its way into the markets of the state. Its principal use is to furnish seed to grow seedlings on which to propagate different citrus fruits. Everbearing is grown here and there as a home fruit. *Ponderosa*, a large-fruited variety, is grown as a yard tree. When filled with fruit, the tree is very ornamental and the fruit is valuable for home use. This great fruit may be mistaken for a grapefruit (see *Pomelo*).

Lemon trees in Florida, are grown almost entirely on *Sour orange* and *Rough lemon* stocks, choice between these two being governed by the soil type and moisture conditions. It is best that the stocks be budded some distance above the ground. In northern Florida, *Villa Franca* is sometimes grown on *Poncirus trifoliata* stock and fruit is often secured.

Plantings are usually spaced 20 to 25 feet apart each way and the general care and cultivation is much the same as for other citrus fruits. In general, the plan pursued is to cultivate frequently during the usually dry spring season, March to June, after which a cover-crop of beggarweed, native grasses or cowpeas is given possession of the ground. By the middle of November, this cover-crop should be incorporated with the soil, either by shallow plowing or by cutting it in with a disc-harrow. It has been frequently demonstrated that injury to trees from cold is much less severe if all vegetation is cut into the soil, than if the ground is covered with grass and weeds.

Pruning requires careful attention to keep the trees low and compact. Lemons are very prone to produce long bare branches without fruiting twigs. They must be headed in to cause the development of fruiting spurs well in toward the center of the tree.

Protection of the fruit and trees must be provided. Up to this time the Scheu oil-heater is the best heating device that has been brought forward for this work. The temperature must not be allowed to go below 29° F. for any length of time if there is fruit on the trees. With these heaters there is no question but that the trees can be protected against cold in the southern parts of the state.

H. HAROLD HUME.

The lemon in California.

In general, the culture of lemons in California is similar to that of oranges (which see). Especially is this true in regard to soil requirements, propagation, irrigation, fertilization, and the like. The picking and handling of the fruit and pruning of the trees, however, differ radically from that of the orange.

The commercial lemon areas of California are situated near the coast, chiefly in the counties of San Diego, Orange, Los Angeles, Ventura and Santa Barbara,

and in the western corner of San Bernardino. In this region the cool, moist summer climate causes the trees to bear a larger proportion of high-priced summer fruit. In the hot interior valleys some lemons are produced also; but while the trees will grow just as well under desert conditions, the fruit tends to mature mostly in the winter when the price is low. The fruit itself under such conditions is shorter-lived and will not keep so long nor ship so well as that produced near the coast.

Lemons are picked from ten to twelve times a year, each lemon being removed from the tree when it has reached a certain size, namely $2\frac{1}{4}$ inches in diameter. Each picker carries an iron ring of the above diameter and removes every fruit which will not pass through it, regardless of whether the lemon is ripe and yellow or perfectly green. Great care is taken to avoid the slightest abrasion of the skin. The stems are clipped off even with the "button," and the fruit is handled only in gloved hands and canvas picking-bags. The largest pickings are ready in the winter from December 1 to March 1, and as this is the time when the price of lemons is low, it is necessary to defer picking the main crop till March and April and to store an immense amount of fruit, holding it until the high prices of summer prevail. Sometimes seventy-five or one hundred carloads of lemons are stored in one house and held for three to six months. The smallest pickings come in the summer from June 1 to October 1, at a time when the price is the highest. It is necessary, therefore, to subject the green lemons to such an artificial treatment as will result in a good color in the shortest time possible. Thus the lemon-grower has two problems: one is to be able to retard respiration and the ripening process as much as possible and the other to accelerate these same processes.

For the process of spring storage, large houses are provided which are so constructed as to admit of perfect control of ventilation. On the storage-floor, there are a number of suspended canvas tents, each tent accommodating one carload of fruit. When the fruit is brought from the orchard, it is washed in a solution of one-fiftieth of 1 per cent of copper sulfate in water and piled loosely in boxes which are stacked under the tents. During moist, foggy weather the tents are raised and free circulation of air permitted. Should a dry, hot wind from the desert prevail, the tents are kept closed as tightly as possible in order to retard evaporation.

Lemons picked in September, however, after being run through the copper sulfate solution, are removed to a small fireproof building known as a sweat-house. The sweat-house usually has several rooms, each room accommodating one carload of fruit. The fruit is stacked in these rooms in the picking-boxes, the greenest and most immature in the rear and the lightest-colored fruit next the door. The room is then closed tightly and several kerosene stoves are burned in a basement below. Pans of water are kept on the stoves and the gases arising pass through cracks in the floor into the fruit-room. These gases consist of a mixture of carbon dioxide, carbon monoxide and water vapor. The temperature of the room is held as near 90° as possible and is regulated by the number of burners under the room. Great care is taken to keep the atmosphere saturated with moisture. Lemons are artificially colored in this manner in three to six days, depending on the depth of the green color in the rind.

The curing process causes the lemons to shrink in size slightly and the rind becomes thinner, more pliable, with a texture and general finish greatly desired by the market. During the whole process of picking and curing lemons they are handled very much more carefully than oranges. The grading and sizing is done almost entirely by hand, the washing-machine being the only bit of machinery through which lemons are passed.

For many years the lemon business in California did

not flourish. Until fifteen years ago, California lemons had a very bad reputation for decay in the eastern markets, and perhaps justly. California growers did not possess the knowledge and the skill necessary for successful handling. One of the most serious troubles of those days was the brown-rot, which not only destroyed a third or more of the lemons on each tree in the orchard, but continued its ravages in the storage-house. The nature of this and many of the other troubles is now well understood and control methods systematized. The business has been readjusted to conditions until the old bad reputation has been lived down and by 1912 California lemons were selling steadily in the New York City auction at a premium over the European product.

On account of the peculiar troubles to which the lemon is susceptible, the expenses of production are greater than in the case of the orange. Until recently the increased tariff has to some extent offset this difference and at present the acreage of bearing lemons is being increased very rapidly.

Practically all varieties of any value in the Old World were introduced into California and tested out in the early days. Most of them, however, were not suited to our climatic conditions. Fifteen years ago the list had been reduced to six, namely the Eureka, Lisbon, Villa Franca, Genoa, Bonnie Brae and Messina. Five years ago the list had shrunk to three varieties, the Eureka, Lisbon and Villa Franca. Today the Eureka is practically the only variety widely planted, although there are many old orchards of the other varieties still in bearing. The Eureka is a seedling which originated in Los Angeles. During the years of its propagation it has split up into several strains, some of which are very much more desirable than others. The best strain of Eureka is precocious, vigorous, prolific, thornless and almost seedless. The chief objections to the Eureka are its habit of throwing out long, ungainly branches which fruit on their ends, and the thinness of the foliage in the springtime which allows a good many lemons to sunburn.

While the orange requires only a medium amount of pruning, the lemon tree demands almost constant attention. The young tree should be regularly pinched back and built up wholly of short, stocky branches, strong enough to bear a heavy load. All growth is cut off at some arbitrary level, at 8 to 10 feet from the ground. A great many vigorous young shoots will arise from the top and should be removed twice each year, once in the spring and again in late summer. In addition to this, many of the large growers keep a gang of expert pruners occupied the year round cutting out the weak and decadent branches and thinning the fruiting brush. One experienced pruner working continuously will care for 25 to 40 acres of Eureka lemons, and a somewhat less amount of Lisbons, which are very thorny and not easily handled. J. ELIOT CORT.

LEMON VERBENA: *Lippia*.

LEMON VINE: *Pereskia*.

LEMÓNIA: *Ravenia*; see *Limonia*.

LENOPHYLLUM (trough leaf). *Crassulacæ*. A genus established by J. N. Rose in 1904 for *Sedum guttatum* and other species: perennial herbs branching at the base; lvs. a few opposite pairs clustered near the base, very thick and somewhat flattened and more or less concave on upper surface; fls. yellow (or drying reddish) in an erect infl. or solitary; sepals 5, equal, nearly distinct; petals erect, distinct, spreading or recurved at top; stamens 10; carpels narrow and erect. —Species about a half-dozen, Mex. and Texas. They are tufted plants a few inches high, to be treated like cotyledons or echeverias. *L. guttatum*, Rose, and *L. Weinbergii*, Brit., are the names most likely to appear; both are Mexican. L. H. B.

LÉNS (ancient name of the lentil). *Leguminosæ*. The lentil is one of the important food plants of the human race, although little grown in North America. Closely allied to *Vicia*, from which it is distinguished chiefly by the 2-ovuled ovary and 1-2-seeded pod, *Vicia* usually having more than 2 seeds. Low erect or partially climbing herbs: lvs. pinnate, the terminal lft. sometimes ending in a bristle or tendril, the lfts. 2 to many pairs and entire: fls. small, bluish white, racemose or solitary, papilionaceous; calyx-lobes nearly equal and elongated; standard broadly obovate or nearly orbicular; wings oblique, obovate, partially adhering to the short keel: pod compressed, 2-valved, 1-2-seeded; seeds lenticular.—Species about a half-dozen, in the Medit. region and W. Asia, apparently only one of economic importance.

esculénta, Moench (*Érvum Léns*, Linn. *Vicia Léns*, Coss. & Germ.). **LENTIL**. Annual, much-branched, 1-1½ ft. high: lvs. with numerous oval or oblong-oval lfts., ending in a tendril: fls. small, white or pale blue, axillary, in pairs: pods short and broad, very flat, and containing 2 flat seeds rounded in outline and convex on both sides. S. Eu.—The lens of the astronomer and physicist was named because it was shaped like one of these seeds. Some varieties have gray seeds, others red. Esau sold his birthright to Jacob for a mess of red pottage made of lentils. The seeds are used chiefly for soups and stews. They are a coarser and cheaper food than fresh peas and beans, and about as palatable as split peas. Lentils rank amongst the most nutritious of vegetables. They are also of the easiest cult., but the seeds are often destroyed by a weevil. There are many cult. varieties. The seed is usually sown in drills in March, 18-30 in. apart. The heaviest crops are produced on rather dry sandy soils. The plants need no special care between seedtime and harvest. The seeds keep better in the pods than after being threshed. The herbage makes good fodder. See *Cyelo*. Amer. Agric., Vol. II, p. 308. L. H. B.

LENTIL: *Lens*.

LEONÔTIS (Greek, *lion's ear*, which the flowers are supposed to resemble). *Labiâtæ*. **LION'S EAR**. **LION'S TAIL**. This includes a tender shrub with scarlet-orange, gaping flowers, cultivated outdoors in southern Florida and southern California; and it is an excellent winter bloomer under glass.

Annual or perennial herbs, coarse and tall: lvs. opposite, petiolate, ovate: fls. white or yellow in very dense axillary whorls; calyx 8-10-ribbed, the tube arched and funnel-shaped; corolla-tube as long as calyx; upper lip long and concave, outside hairy; lower lip deflexed, the 3 lobes nearly equal; stamens 4, arched, didynamous; style 2-lobed.—Species about 20 in Trop. and S. Afr., one more widely dispersed.

Leonûrus, R. Br. Branched perennial with hairy sts., shrubby, 3-6 ft. high: lvs. 2 in. long, lanceolate or oblong-lanceolate, obtuse, coarsely serrate, narrowed at the base, pubescent: corolla more than thrice as long as the calyx, red-yellow or orange-red, 1½-1¾ in. long, pilose, the upper lip large and the lower small; stamens not exerted. S. Afr. B.M. 478 (as *Phlomis Leonurus*). R.H. 1857, p. 548. Gn. 53, p. 460. G.C. II. 19:186; III. 43:139. J.H. III. 53:255. G.W. 7, p. 100; 13, p. 14. G. 8:22; 13:313; 36:65. R.H. 1913, p. 92. Var. **globôsa nana**, is a dwarf form, not exceeding 2½ ft. in all, and with a regular and rounded habit of growth. It is said that *L. Leonurus* has become a menace in S. Afr., with laws to provide for its destruction. In the North, *Leonotis* cuttings should be started in early spring, the young plants transplanted to the open in May and thereafter frequently pinched to make a symmetrical instead of a straggling bush, and if the plants do not flower before frost, they can be cut back, lifted and brought into a cool greenhouse to flower in Nov. or

Dec. A southern enthusiast says that they are as easy to cult. as a geranium. There is a white fld. form.

L. dysophylla, Benth., has orange-yellow fls., and differs from *L. Leonurus* also in the broader lvs. and longer calyx-teeth. S. Afr. B.M. 8404.—*L. nepetafolia*, R. Br. Annual, 1½-6 ft., with 4-angled sts.: lvs. ovate, round-toothed; bracts spinescent: fls. yellow or orange-red, in distant-globose bur-like whorls; corolla 1 in. long. Many tropics; reported as a showy plant in Porto Rico.

WILHELM MILLER.
L. H. B.†

LEONTÍCE (Greek, *lion's foot*; referring to the shape of the leaf). Including *Bongardia*. *Berberidææ*. **LION'S LEAF**. Hardy herbaceous perennials, chiefly Asian, of low growth and distinct appearance.

Tuberous: lvs. pinnate or pinnatisect, on the st. small or none: fls. yellow, racemose or in a somewhat dichotomous cyme; sepals petal-like, 3-9; petals 6, often reduced to small nectaries; stamens 6, free: carpel 1, becoming a bladderly nearly or quite indehiscent caps.—Species perhaps a dozen, S. Eu. to Cent. Asia. Likely to be advertised with Dutch bulbs. These plants have a turnip-shaped corm or rhizome about 2 in. thick, and bear yellow fls. in early spring. *Bongardia*, now included in *Leontice*, has only one species.

A. *Petals reduced to scales or nectaries.*

B. *Lvs. twice ternately cut.*

Leontopétalum, Linn. Height 1-1½ ft.: lfts. ovate or obovate, rarely subcordate: panicle large, dense, leafy. Italy and the Orient.—Root used in the Holyland, against epilepsy.

BB. *Lvs. digitately cut.*

C. *Raceme dense, conical.*

Álberti, Regel. Sts. several, stout, each giving off 2 subradical lvs. which are undeveloped at flowering-time: lvs. finally on stalks 4-5 in. long, digitately 5-parted; lfts. pale green, glaucous, elliptic; nerves prominent and parallel beneath: scape 6-8 in. high, robust; raceme as many as 18-fld.; fls. nearly 1 in. across, ochre-yellow, streaked reddish brown on back; petals shorter than the stamens. Turkestan. B.M. 6900. Gt. 1881:1057.

CC. *Raceme loose, oblong.*

altáica, Pall. Lvs. not from the root, digitately cut, only 1 lf. on each fl.-st., the lf. having 3 primary divisions, each of which is petioled and has 5 lfts., 2 of which are smaller than the rest; lfts. elliptical: infl. a raceme, bearing large, more or less roundish leafy bracts; fls. mostly erect, having 6 showy, oblong, not overlapping, entire parts supposed to be sepals, the petals small, yellow, erect, shorter than the anthers. S. Russia, Altai, Siberia. B.M. 3245.

AA. *Petals large and prominent.*

Chrysógonum, Linn. (*Chrysógonum Dioseoridis*, Rauw. *Bongardia Raivolfii*, C. A. Mey). Of the subgenus *Bongardia*. Lvs. all from the root, pinnate; lfts. 3-8 pairs, or some of the lfts. in whorls of 3-4, wedge-shaped, 3-fld. with a conspicuous triangular crimson mark at the base of each: infl. a panicle, bearing minute, linear bracts; fls. drooping, having 6 showy, wedge-shaped, erenate parts, 3 of which should possibly be considered petals, and the other 3 inner sepals, since there are 3 small, greenish lobes outside which are like an ordinary calyx, and should, perhaps, be called the outer calyx. B.M. 6244. F.C. 3:98. B. 1:50.

WILHELM MILLER.

LEÓNTODON (Greek, *lion's tooth*). *Compósitæ*. A rather weedy group of hardy perennials little grown in Amer. and not unlike the hawkweeds. They are scapose herbs with clustered, basal lvs. much pinnatifid, scapose, with many-fld. heads of rather showy yellow fls.: involuere ovoid or oblong, its bracts in 1 or 2 series; pappus of plumose bristles, differing in this from *Hieracium*, its nearest horticultural relative.

L. autumnale, Linn., FALL DANDELION, is sometimes cult. in Amer. It becomes weedy, but its late-flowering yellow heads are attractive to some. Eu., but naturalized in E. N. Amer. N. TAYLOR.

LEONTOPÒDIUM (Greek, *lion's foot*). *Compositæ*. Perennial herbs, all tufted and woolly, of which the edelweiss is perhaps the one flower most sought by tourists in the Alps. It is an emblem of purity.

Stems ascending or erect, unbranched except at the very top; st. lvs. alternate, entire; heads small, crowded into dense cymes surrounded by a sort of leafy involucre. About 6 widely scattered species. Edelweiss is still catalogued as a *Gnaphalium*, but in that genus the style is 2-cut, while in *Leontopodium* it is uncut. *Leontopodium* is more nearly allied to our common weed, the "pearly everlasting" (*Anaphalis margaritacea*), which lacks the dense cluster of star-like floral lvs., but in the opinion of some has as much beauty as the edelweiss.

The edelweiss is a low plant, 4 to 12 inches high, densely covered with a whitish wool, the attractive portion being the flat star-like cluster of woolly floral leaves surrounding the true flowers, which are small, inconspicuous and yellow. The general impression seems to be that edelweiss cannot be cultivated in America. In 1900, however, it was extensively advertised as a pot-plant, and it has long been cultivated in rock-gardens. J. B. Keller says, "It can be grown to perfection in an elevated position of the rockery, in rather light soil and with full exposure to sun. It also succeeds in an ordinary hardy border where the plants can be kept moderately dry in winter."

Seeds of edelweiss should be sown about February 1, which gives plants large enough to plant out in permanent quarters about May 1. If planted in good well-drained ground, the plants are sure to make a good growth so that by the middle of September there will be an occasional flower. However, it is not until the following year that one gets a full crop of flowers, so many in fact that it seems to exhaust the plants, which should now receive a good deal of care. Old plants divided early in the fall and wintered in coldframes give very good results, or late-sown seedlings carried over winter in the same way do well. (Albert E. Robinson.)

To establish a colony of edelweiss an English writer (Gn. 52, p. 116) advises that a few stray seedlings be



2132. Edelweiss.—*Leontopodium alpinum*. ($\times \frac{1}{2}$)

firmly planted in a narrow chink of rock so placed that a deep fissure of gritty or sandy loam may be assured for the roots to ramble in. Plants in pots may be grown and flowered when the collar is tightly wedged between some pieces of stone or old mortar. The plant is best propagated by seeds, as division is not always successful.

alpinum, Cass. (*Gnaphalium Leontopodium*, Linn. *L. homalagnum*, DC.). Fig. 2132. Creeping by stolons; lvs. lanceolate, white-tomentose beneath, floral ones oblong; fl.-heads 7-9 in a cluster; involueral

scales woolly at base, blackish at apex. B.M. 1958. Gn. 20, p. 529; 52, p. 146; 60, p. 344; 62, p. 115. G.L. 18:47; 24:181.

sibiricum, Cass. St. simple, bearing numerous oblong-linear, often webby lvs.; fls. borne in a densely corymbose cluster, white, and nearly twice the size of the preceding. Russia.—Can be grown readily at much lower elevations than *L. alpinum*.

L. japonicum, Miq. (*Gnaphalium Sieboldianum*, Frauch. & Sav.). Fls.-heads looser; lvs. shining dark green above, underneath silvery. N. TAYLOR.†

LEONÛRUS (Greek compound, meaning *lion's tail*).

Labiata. About 10 species of herbs, some of them weedy and widespread, but scarcely horticultural subjects. *L. Cardaca*, Linn. (*Cardaca vulgaris*, Moench. *L. villosus*, Desf.), is the common motherwort; weed or escape about buildings and in waste places, from Eu.: perennial, tall, with long-petioled lvs., the lower 3-cleft; fls. purple (sometimes white) bearded, in axillary whorls; calyx with prickly teeth. Said to be a good bee-plant.

LÉPACHYS (Greek, *a thick scale*; probably referring to the thickened upper part of the bracts of the receptacle). Including *Ratibida*. *Compositæ*. Annual or perennial herbs, the most popular of which is a fine prairie wild-flower, *L. columnaris*, for which, unfortunately, there is no common name.

Lepachys contains 4 species of herbs, all American, 3 perennial; lvs. alternate, pinnately divided or parted; disks at first grayish, their corollas yellowish, becoming tawny; chaffy bracts commonly marked with an intermarginal purple line or spot, containing volatile oil or resin; achenes flattened, sharp-margined or winged. For generic distinctions, see *Rudbeckia*.

Lepachys columnaris grows 2 to 3 feet high, has elegantly cut foliage, and bears flowers something like a brown-eyed Susan, but the disk is finally cylindrical and more than an inch high, with 6 or 7 oval, reflexed rays hanging from the base. In a fine specimen these rays are $1\frac{1}{2}$ inches long and nearly 1 inch broad. There are 5 inches or more of naked wiry stem between foliage and flower. Typically, the rays are yellow, but perhaps the most attractive form is var. *pulcherrima*, which has a large brown or brown-purple area toward the base of each ray. Like the greater number of our native western flowers that are cultivated in the eastern states, the plants have reached our gardens from European cultivators. Meehan says it is perfectly hardy in our northern borders, but the English do not regard it as entirely safe without some winter protection. Moreover, it is one of the easiest herbaceous perennials to raise from seed, flowering the first year, and it is chiefly treated in the Old World as an annual bedding plant, the seeds being known to the trade as *Obeliscaria pulcherrima*. For bedding, the seeds are sown in early spring in a hotbed, the seedlings pricked off into boxes, hardened off, and finally transplanted to the open, only slight care being necessary to obtain compact bushes about 2 feet high. Under such circumstances the plants flower from June to September, and the season may be prolonged by a sowing in the open. This has proved useful in our northern borders, where seed should be thinly sown in the open, where the plants are to stand, with a fair chance of autumnal bloom the same year. The flowers last well in water and should be cut with long stems to get the benefit of the delicately-cut foliage. *L. pinnata* is perfectly hardy at New York and is a serviceable perennial.

A. Rays oval, scarcely as long as the disk at its longest; fl.-segments linear.

columnaris, Torr. & Gray (*Ratibida columnaris*, D. Don). Fig. 2133. A rough-pubescent perennial, branching from the base, 1-2½ ft. high in the wild, often

higher in cult.: st.-lvs. with 5-9 divisions, which are oblong to linear in outline and sometimes 2-3-cleft: fls. solitary, terminating the branches; rays yellow; style-tips short, obtuse. Prairies, Saskatchewan to Texas and Rocky Mts. B.M. 1601. Mn. 1:65.

Var. *pulcherrima*, Torr. & Gray (*Obeliscaria pulcherrima*, DC.), differs only in having the rays partly

or wholly brown-purple. The plants in the trade are mostly margined with yellow or have about half of each color. Gn. 51:98. R. H. 1854:421. Var. *tôtus purpureus*, Hort. D. M. Andrews, is "a variety with dark orange-brown rays, almost black."

AA. Rays oblong-lanceolate, very much longer than the disk: lf.-segs. lanceolate.

pinnata, Torr. & Gray (*Ratibida pinnata*, Barnh.). Slender, 3-5 ft. high: lvs. with 3-7 lfts., which are lanceolate, sparsely serrate, sometimes lobed, the uppermost run together, very rough-hairy:



2133. *Lepachys columnaris*. ($\times \frac{1}{4}$)

rays yellow, often 2 in. or more long. W. N. Y. to Ia., south to La. B.M. 2310. Gn. 47:418; 51, p. 205.—It is at home in a sunny border.

J. H. COWEN.
N. TAYLOR.

LEPÁNTHEs (*scale flower*). *Orchidaceæ*. Some forty species of the mountains and upper parts of Mex., Cent. Amer., W. Indies and S. Amer., epiphytic, monophyllous, allied to *Pleurothallis* but differing in bearing club-shaped pollinia and a usually 2-parted lip that is adnate to the column. None is offered, and the species are of little importance horticulturally.

LEPICÝSTIS: *Polypodium*.

LEPIDÁGATHIS (Greek, *scale* and *ball*, in allusion to the curved infl.). *Acanthaceæ*. Tropical herbs and shrubs; one is in horticultural literature as a warm-house evergreen shrub. It is *L. cristata*, Willd., in Trop. India, with purplish fls., linear or oblong nearly glabrous lvs. and spinose-acuminate bracts and bracteoles: fls. in globose clusters or heads near the base of the plant; corolla $\frac{1}{2}$ in long, in bud densely hairy, white with purple or brown spots: sts. 6-24 in., procumbent. *Lepidagathis* has about 50 species, of which two are in the American tropics and the others in the Old World. It is little known to cultivators.

LEPIDÍUM (from Greek for *little scale*, alluding to the small flat pods). *Cruciferae*. CRESS. PEPPER-GRASS. Small mostly unattractive herbs (or rarely subshrubs), one of which is a salad plant. See *Cress*.

Annual, biennial or perennial, erect or spreading, with many small white fls.: lvs. very various, simple to more or less bipinnate: fls. mostly racemose, often with leafy bracts intervening; petals small or wanting;

stamens 2-6; pod circular, flattened against or contrary to the partition; seed 1 in each cell; cotyledons in most cases incumbent.—Perhaps 100 species in many parts of the world. There are about 20 native species, mostly western, and several intro. weedy species. The foliage and pods have an aromatic-peppery flavor. The herbage of some species is used as salad, and the pods are sometimes fed to tame birds (whence the name "canary grass"). There are no species of much ornamental value.

sativum, Linn. GARDEN CRESS. Annual, 1-2 ft., glaucous when in fl. and fr., glabrous: fls. small and inconspicuous, in an elongating raceme: pods nearly circular, bifid at the apex, winged: lvs. exceedingly various, but usually the radical ones pinnately divided and subdivided, the central cauline ones 2-3-cleft, nearly to the base and the segms. entire or toothed, the uppermost simple and entire. W. Asia, but widely disseminated as a cult. plant, and sparingly run wild in the northern part of the U. S. and Canada.—Under cult. the foliage varies immensely. The curled sorts have lvs. as finely cut as curled parsley. On Australian cress, which is a golden-ld. form, there are sometimes on the same plant broad-spatulate, ragged-edged lvs., cut lvs., and simple linear lvs.

Other lepidiums are sometimes eaten, but are not in the trade and are of little importance. One of these is the common *L. virginicum*, Linn., wild in the U. S., and known as pepper-grass.

L. H. B.

LEPTACTÏNA (Greek, *graceful rays*, referring to the star-like aspect of the flower). Also written *Leptactinia*. *Rubiaceæ*. Showy shrubs, glabrous or puberulent, leafy: lvs. opposite, glossy; stipules broad-ovate and mostly rather large: fls. in dense terminal cymes, like ixoras, white.—The genus contains about 25 species, all Trop. African shrubs, important generic characters being the large calyx-lobes, very long corolla-tube, 5 included stamens, style-branches free or connate, large lax stipules, and clustered infl.

L. Mannii, Hook. f. Branching shrub, 6 ft. high: lvs. $5\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. wide and larger in proportion, oval, wavy-margined, obtuse, with gobose green bodies between the insertions of the lvs., which are stipules: calyx-tube 3 lines long, lobes 1 in. or more long, leafy; corolla silky within, lobes lanceolate; stamens 5, included; style hairy above, 2-branched. B.M. 7367.—A very interesting white-fl. shrub for growing under glass, apparently not offered in this country.

L. H. B.

LEPTÁNDRA: *Veronica*.

LEPTARRHÈNA (name refers to the slender or thin anthers). *Saxifragaceæ*. One perennial caulescent herb, *L. pyrolifolia*, R. Br. (*L. amplexifolia*, R. Br. *Saxifraga pyrolifolia*, Don), from Kamtschatka and Alaska to Wash., sometimes mentioned in horticultural literature: caudices short and leafy, the lvs. alternate, leathery and evergreen, toothed, narrow to base, the radical ones 1-4 in. long and obovate to oblong or spatulate, those on the fl.-stalks 1 or 2 and clasping: fls. small, white, in bracted panicles, on scape-like sts. 8-16 in. high; sepals 5, erect; petals 5, narrow, persistent; stamens 10; ovary of 2 nearly distinct carpels, becoming foliaceous. Probably a good plant for wild-gardening where proper conditions can be found; recorded as growing "in high mountain marshes."

L. H. B.

LEPTINÉLLA: *Cotula*.

LEPTOCÁRPHA (name refers to the slender scales or chaff). *Compósita*. A subshrub from Chile and Peru that has been grown abroad for the yellow fl.-heads. *L. rivularis*, DC., the only species, has alternate or sometimes opposite ovate, toothed, and scabrid lvs. about 2 in. long, and heads about 1 in. diam. A half-hardy or greenhouse plant allied to *Helianthus*.

LEPTOCHÏLUS (from the Greek referring to the linear form of the fruiting frond). *Polypodiaceæ*. A group of inoderate-sized tropical ferns, allied to *Dryop-*

teris, but formerly classified under *Aerostichum*. The lvs. are pinnately divided; the sporangia are borne very close together so that at maturity they appear entirely to cover the backs of the fertile lvs.

aliënus, Swartz. (*Aerostichum aliënum*, Swartz). Sterile lvs. 1-2 ft. long, triangular, with the upper pinna decurrent, and the lower at least sinuate or even incised; fertile lvs. smaller, with narrow pinnae, the upper decurrent. Cuba and Mex. to Brazil.

nicotianæfolius, C. Chr. (*Aerostichum nicotianæfolium*, Swartz). Sterile lvs. with 3-7 pinnae which are 6-12 in. long and 2-3 in. wide, with nearly entire edges; fertile lvs. smaller, with 3-7 pinnae 3-4 in. long, 1 in. wide. W. Indies to Brazil. R. C. BENEDICT.†

LEPTOCHLÔA (*slender and grass*, from the Greek, referring to the slender spikes). *Graminææ*. Annual or perennial grasses with rather showy inflorescence, one species occasionally grown for ornament.

Plants with flat blades and slender unilateral spikes arranged along a main axis; spikelets 2- to several-fl.

Species about 12, in the warmer regions of both hemispheres. Differs from *Chloris* and other genera of the tribe Chlorideæ, in having racemously arranged spikes with several-fl. spikelets.

virgata, Beauv. Erect, glabrous, usually glaucous perennial, 2-4 ft.; spikes numerous, 3-6 in., on an axis 3-6 in. long; spikelets 3-6-fl.; florets awless or with an awn shorter than the body. Trop. Amer.—Has been advertised under the name of *Chloris gracilis*. A pleasing grass with feathery infl. suitable for borders in the South. A. S. HITCHCOCK.

LEPTOCÔDON (*slender bell*, from the shape of the flowers). *Campanulacææ*. Twiner, suitable for the greenhouse. From *Campanumæa* it differs in bearing a dehiscent caps. rather than a fleshy berry, and from *Codonopsis* in having a tubular upwardly inflated rather than mostly campanulate corolla. The single species is *L. gracilis*, Hook. f. & Thom. (*Codonopsis gracilis*, Hook. f. *Campanumæa gracilis*, Hort.), of Sikkim (India); glabrous slender perennial with alternate and opposite long-stalked ovate-crenate lvs.; corolla 1-1½ in. long, blue, tubular-curved, shortly 5-lobed, the calyx very deeply 5-lobed; stamens 5, free, with as many glands intervening; fls. terminal and opposite the lvs., single on slender peduncles. L. H. B.

LEPTODÁCTYLON: *Gilia*.

LEPTODÉRMIS (Greek, *leptos*, thin and *derma*, skin, membrane, referring to the thin membranous bractlets connate into a tube.) *Rubiacææ*. Low shrubs with small foliage, and small tubular white or purplish flowers in usually few-flowered clusters appearing during summer and fall when few shrubs are in bloom.

Slender-branched, with opposite small entire stipulate lvs.; fls. in axillary head-like clusters; calyx 5-toothed, persistent; corolla tubular-funneliform, with 5-lobed limb; stamens 4, included; ovary inferior, 5-celled; style slender, 5-parted at the apex; fr. a caps., the outer wall splitting to the base into 5 valves, the inner net-like, closed, enveloping the seed.—About 10 species in China and Himalayas. Interesting for botanical collections as one of the few woody representatives of *Rubiaceæ* which are hardly north. A few species have been recently intro. from China, of which the following has proved fairly hardy at the Arnold Arboretum, but appears to be short-lived. Prop. by greenwood-cuttings in summer and by seeds.

oblônga, Bunge. Shrub, to 3 ft.; lvs. oblong or elliptic-ovate, acute, narrowed at the base into the short petiole usually scabrid, ½-¾ in. long; fls. in sessile, dense and few-fl. clusters; corolla slender, tubular,

with oblong-lanceolate spreading lobes, puberulous outside, violet-purple, ¾ in. long; style exceeding the hairy mouth. N. China. July-Oct.

ALFRED REIDER.

LEPTOLÆLIA. Hybrid of *Leptotes bicolor* (seed parent) and *Lælia cinnabarina*, known as *Leptolælia Veitchii*.

LEPTÓPTERIS (Greek, *cut fern*, alluding to the filmy texture of the lvs.). *Osmundacææ*. About 6 greenhouse ferns with sporangia like those of *Osmunda* but with filmy lvs. like those of *Hymenophyllum*. These *sporangia* grow on the backs of the lvs. as in ordinary ferns. A group of beautiful ferns which require special cult. All are from the Australasian region. Allied to *Todea*.

supérba, Presl. With an erect woody st. 12-18 in. high; lvs. 2-4 ft. long, 6-10 in. wide, tripinnatifid, pinnae close together, narrow, reduced below. New Zealand. R. C. BENEDICT.

LEPTÓSIPHON (name alludes to the slender flower). *Polémoniacææ*. A genus founded by Benthams, but now made a section or subgenus in *Gilia*. *L. densiflôrus*, Benth. (*G. densiflôra*, Benth.), is a common garden annual, by some now separated as *Lindanthus densiflôrus*, Benth., native in California. *Leptósiphon aureus* and *L. hybridus* are accounted for under *Gilia micrantha* (p. 1337).

LEPTOSPÉRMUM (Greek, *slender seed*). *Myrtacææ*. Ornamental woody plants grown chiefly for their copiously produced flowers and also for the neat myrtle-like foliage.

Evergreen shrubs or small trees; lvs. alternate, small, rigid, entire, nerveless or 1-3-nerved; fls. short-stalked or sessile, solitary or 2-3, axillary or at the end of short branchlets; sepals short and broad; petals roundish, clawed, spreading; stamens many; ovary inferior, inclosed in the calyx-tube, 3-10-celled; style short; fr. a loculicidal caps., usually protruding above the calyx-tube; seeds numerous, linear, or few and compressed and winged.—There are about 25 species mostly in Australia, few in New Zealand and in the Malay Archipelago.

The leptospermums in cultivation are upright shrubs with slender branches densely clothed with small rigid foliage and covered in spring with numerous white, rarely pink or carmine flowers ½ to ¾ inch across; the capsules are small and insignificant. They are cultivated somewhat outdoors in California, or in the North in the greenhouse and treated like heath and other Cape and Australian hardwood plants. Planted outdoors they stand drought well and *L. lavrigatum* has been employed by the hundred thousands in the reclamation of the moving sands on the San Francisco promontory where the Golden Gate Park is now established. For greenhouse culture, *L. scoparium* var. *bullatum* is an exceptionally good plant for those who can grow heaths. It is far better than *L. lavrigatum*.

Cuttings taken from well-ripened wood in the fall or from the young growth in summer root freely under the same treatment given erica. For a potting soil, use two parts leaf-mold and one of sand. Plunge the pots outside during the summer in the full sunlight. The plants make a straggling growth, unless trimmed into shape. By fall they will be covered with buds, but it is impossible to force them into bloom for Christmas. Keep the plants in a cool house with ericas or azaleas until the latter part of February or March, and then give them a little more heat, say 55° to 60°. The plants will soon be a mass of white flowers. *L. scoparium* var. *bullatum* does not grow rapidly, but, like ericas, as it grows older it makes fine specimens. It has tough foliage, stands much hard usage, and when in bloom attracts plant-buyers. It deserves greater popularity.

Propagation is by seeds sown in spring and treated like those of *Erica* or *Rhododendron*, but usually by cuttings of young wood in May under glass, or of nearly mature wood in autumn and kept in winter in temperate house.

A. Ovary usually 10-celled.

laevigatum, F. Muell. Tall shrub, attaining 20–30 ft., glabrous and somewhat glaucous: lvs. varying from obovate-oblong to oblong-cuneate or narrow-oblong, obtuse, $\frac{1}{2}$ –1 in. long, 3-nerved: fls. white; calyx glabrous: caps. slightly protruding above calyx-tube. Austral. B.M. 1304 (as *Fabricia laevigata*). G.C. II. 25:816; III. 9:45.

AA. Ovary usually 5-celled.

B. Calyx-tube glabrous.

c. Lvs. flat or with recurved margins, obtuse or scarcely pointed (except in the large variety).

flavescens, Smith. Tall shrub: lvs. usually narrow-oblong to linear-lanceolate or broadly oblong or even obovate, $\frac{1}{2}$ – $\frac{3}{4}$ in. long: fls. about $\frac{1}{2}$ in. across, white. Austral. B.M. 2695. Var. *obovatum*, F. Muell. Lvs. broadly obovate to obovate-oblong, under $\frac{1}{2}$ in. long. Cult. in Eu. under glass. Var. *grandiflorum*, Benth. & Muell. Lvs. rather larger: fls. larger than in any other variety. L.B.C. 6:514.

cc. Lvs. flat or concave, sharp-pointed, narrow or small.

scoparium, Forst. Attaining 10–12 ft.: lvs. ovate to linear-lanceolate or linear, mostly under $\frac{1}{2}$ in. long. Otherwise, almost exactly as in *L. flavescens*. Var. *juniperinum*, Nichols. (*L. juniperinum*, Smith). A narrow-lyd. form with pubescent pendulous branchlets. Var. *bullatum*, Rehd. (*L. bullatum*, Hort.). Lvs. larger, narrow: fls. larger, about $\frac{3}{4}$ in. broad. G.C. III. 51:100. G. 30:415. R.H. 1903, p. 375. R.B. 30, p. 44. J.H. III. 30:435. Var. *Nicholii*, Turrill. Fls. carmine: lvs. purple, but green in plants grown under glass. Gn. 77:612. B.M. 8419. R.H. 1912:520. Var. *grandiflorum*, Hook. Fls. large, pink or nearly white. B.M. 3419. Gn. 51:390. Var. *Chapmannii*, Dorrien Smith. Lvs. brownish: fls. bright rose. New Zeal. Var. *Boscawenii*, Bois. Fls. 1 in. across, cherry-red in bud, white with reddish center when expanded. New Zeal. R.H. 1912:520. G.C. III. 51, suppl. One of the most desirable forms. It is said to be of relatively easy cult., with compact habit, the branches spreading in all directions. Excellent plants for the amateur, but very slow-growing. *L. scoparium* is the manuka or tea-tree of New Zeal.

bd. Calyx-tube more or less densely clothed with silky or woolly hairs.

pubescens, Lam. (*L. lanigerum*, Smith). Tall shrub or small tree: branchlets villous: lvs. varying from obovate-oblong to elliptic or narrow-oblong, normally $\frac{1}{2}$ in. long, silky-villous while young, rarely glabrous: fls. $\frac{1}{2}$ – $\frac{3}{4}$ in. across, white. Austral. L.B.C. 8:701; 12:1192. B.M. 1810. I.H. 32:570. G.C. II. 12:427. Gn. 19:42, and 27, p. 145. G. 29:642.—Extremely variable. Long cult. abroad, but not advertised in Amer.

L. flexuosum, Spreng. (*Agonis flexuosa*, Schauer). Tall shrub or tree, to 40 ft.: branchlets at first pubescent, finally glabrous: lvs. lanceolate or linear-lanceolate, 3-nerved, $\frac{1}{4}$ – $\frac{1}{2}$ in. long: fls. white, over $\frac{1}{2}$ in. across, in axillary heads; calyx pubescent, stamens 20. Austral.—This species is now generally referred to *Agonis* which differs from *Leptospermum* chiefly in the capitate infl. and in the cells of the ovary having only 2–6 ovules ascending from a basal placenta.

ALFRED REHDER.†

LEPTOSYNE (Greek, *slenderness*). *Compositae*. Yellow-flowered composites, with much-divided foliage like *cosmos*.

Smooth and glabrous herbs and subshrubs: lvs. alternate or opposite, usually rather fleshy, and ternately or pinnately divided or dissected. They are the representatives of *Coreopsis* on the western side of the continent, but have mostly pistillate rays and always a ring on the tube of the disk-fls.—Seven species, all from Calif. except *L. arizonica*. The genus is united

with *Coreopsis* by some authors, including Hoffmann in Engler & Prantl.

In the North these plants are mostly treated as half-hardy annuals. None of them has anything like the popularity of either *cosmos* or *Coreopsis tinctoria*. The commonest species is *L. maritima*, but *L. Stilmanii* promises to outrank it, although not well known in the trade. *L. Stilmanii* is said to bear flowers $1\frac{1}{2}$ inches across, for 5 or 6 weeks. Its seed germinates quickly and can be sown outdoors. Sandy soil and a sunny position are advised. It is said to bloom in four to five weeks after sowing. *L. maritima* should be started indoors, transplanted in May, and can be brought into flower by July. Two distinct plants are passing in the trade as *L. maritima*, one of which is *L. calliopsidea*, and is considered an inferior plant by some. The seeds of the two plants are easily distinguished.

A. Rays obovate.

B. Seeds having long, soft, villous hairs.

calliopsidea, Gray (*Agarista calliopsidea*, DC. *Coreopsis calliopsidea*, Boland.). This is the plant figured in R.H. 1873:330, erroneously as *L. maritima*. Annual, 1–2 ft. high, rather stout and leafy: fls. 3 in. across, long-stalked; rays fewer, shorter and broader than in *L. maritima*, $1\frac{1}{4}$ in. long, $\frac{3}{4}$ –1 in. wide.

BB. Seeds having short, rigid bristles.

Douglasii, DC. (*L. californica*, Nutt. *Coreopsis Douglasii*, Hall). Annual, 9–12 in. high: lvs. 1–3 times parted: fls. on solitary, long-stalked heads; ring of the disk-fls. distinctly bearded. June, July.

BBB. Seeds not hairy.

Stilmanii, Gray. Stouter than *L. Douglasii* and more leafy below, surmounted by a single long-stalked head: ring of disk-fls. beardless. Gn. 52, p. 461. G.C. III. 22:333. R.B. 23, p. 275. Gt. 46, p. 612. S.H. 2:44. G.L. 23:293.—Intro. 1898, by Benary. Annual with linear (not filiform) lf.-lobes.

AA. Rays oblong: perennials.

B. Sts. low, from a thick base.

maritima, Gray (*Coreopsis maritima*, Hook. f.). Perennial: lvs. 2-pinnate: fls. $3\frac{1}{2}$ in. across, borne at the ends of branches on peduncles 9–12 in. long; rays 16–20, $1\frac{1}{2}$ in. long; disk 1 in. across: seeds not hairy. B.M. 6241. Gn. 49:272. Not R.H. 1873:330, which is really *L. calliopsidea*.—Makes a good bog-plant.

BB. Sts. 2–8 ft. high, 1–5 in. thick, somewhat woody, often decumbent.

gigantea, Kellogg (*Coreopsis gigantea*, Hall). Differs in being leafy at the top only, the others being leafy at the base: lvs. 2–3-pinnate: fls. smaller than in *L. maritima*, borne on short corymbose peduncles; disk $\frac{1}{2}$ in. across: seeds not hairy. Cult. in S. Calif. Gt. 44, p. 592. G.C. III. 28:319.—The fls. are said to be sweet-scented.

WILHELM MILLER,
N. TAYLOR.†

LEPTOTÆNIA (*narrow vittæ* or oil-tubes). *Umbelliferae*. Several N. American tall perennial herbs, allied to *Ferula* and *Angelica*: glabrous: roots thick and fusiform: lvs. pinnately compound: fls. yellow or purple, in compound umbels, the involucre and involuclcs none or of few bracts: fr. oblong or nearly obicular, much compressed. Two species were once listed, but probably none is in cult. Manuals of the plants of the Rocky Mt. region and west contain descriptions of the species.

LEPTOTES (from the Greek, referring to the slender parts). *Orchidaceae*. Small terrestrial or epiphytic herbs of slender habit bearing racemes with few pretty flowers produced in spring.

Stems erect, not pseudobulbous, growing from a

creeping rhizome and bearing 1-3 fleshy linear lvs. and a slender but rigid, terminal raceme: sepals and petals nearly equal, spreading; labellum joined to the base of the column; lateral lobes large, spreading or small, auricle-like, middle lobe large, entire, contracted at base, column with 2 wide wings; pollinia 4 perfect and 2 imperfect. —Six species in Brazil and W. Indies. Cult. as for helia.

bicolor, Lindl. (*Tetramiera bicolor*, Rolfe). Lvs. solitary on the short st., semi-cylindric, with a furrow in front, 3-4 in. long; raceme few-fld., shorter than the lvs.; sepals and petals white, linear-incurved, over 1 in. long; lateral lobes of the lip small, folding over the column; terminal lobe oblong-lanceolate, bright rose, with white tip and margins. A pretty plant. B.R. 1625. A.F. 6:633. Gn. 59, p. 77. Var. **glaucophylla**, Hook. Lvs. glaucous. B.M. 3734.

L. unicolor, Rodr. Habit pendulous; fls. pale lilac; lvs. fleshy. Brazil.

HEINRICH HASSELBRING.

LESCHENAULTIA (named for L. T. Lechenault, botanical traveler in the far E.). Written also *Lechenaultia*. *Goodeniaceae*. About 20 species as understood by the latest monographer (Krause, in Engler's *Pflanzenreich*, hft. 54, 1912) of herbs and heath-like shrubs of Austral., sometimes grown under glass: glabrous or rarely hirsute; lvs. heath-like, scattered or crowded, narrow and entire; fls. yellow, red, violet or greenish, solitary or corymbed, showy, with a slender tube and large limb; calyx-tube adnate to ovary, the lobes 5 and linear or lanceolate; corolla oblique, the tube usually slit to the base, on the back, the lobes connivent or spreading; anthers mostly cohering around the style; indusium (or dilated top of style) 2-lipped with a partial

ring of hairs outside; caps. linear, 4-valved, dehiscent. —The *leschenaultias* require special care in watering, and an open soil with plenty of fiber and sand. They are very handsome hardwooded plants for greenhouse growing, but seldom seen in this country.

L. biloba, Lindl. Shrub, 1-3 ft.; lvs. not greatly crowded, about $\frac{1}{4}$ or $\frac{1}{2}$ in. long; fls. blue and handsome, the corolla about $\frac{3}{4}$ in. long, either few on the shoot or corymbed; lobes of corolla longer than tube, spreading, with dark blue veined wings and a point or nubo between. W. Austral. — *L. formosa*, R. Br. (*L. multiflora*, Lodd. *L. Baxteri*, Don). Spreading and much branched, 1-2 ft.; lvs. rather loosely scattered, $\frac{1}{2}$ in. or less long; fls. solitary, red; corolla-tube split to base, 5 lines or less long; corolla somewhat bilabiate, the upper lobes broad and rounded, erect and connivent and shorter than the large and spreading lower ones. W. Austral. B.M. 2600. B.R. 916. L.B.C. 16:1579. — *L. grandiflora*, Lindl., is a large-ld. form of *L. biloba*. — *L. laetina*, Lindl. (*L. splendens*, Hook.). Much branched, erect, 1 ft.; lvs. fine, rather crowded; fls. white to lilac to red, sessile in upper axils; tube of corolla $\frac{1}{2}$ in. long, slit to base; lobes of corolla all similar, usually shorter than the tube. W. Austral. B.M. 4256. F.S. 2:176. H.F. H. 6:14. — *L. splendens*, Hook. = *L. laetina*.

L. H. B.

LESPÉDEZA (D. Lespédez was a Spanish governor of Florida, who aided the botanist Michaux). *Leguminosae*. **BUSH CLOVER**. Small shrubs or herbs with pea-shaped flowers in racemes or heads, some of them very ornamental but mostly not showy; one extensively used for forage.

Leaves pinnately 3-foliolate or rarely 1-foliolate, the lfts. entire and wanting stipules; calyx-lobes nearly equal, sometimes subulate; anthers usually 9 and 1; pod short and 1-seeded (and in this differing from *Desmodium*, which has jointed pods). —Species 40 or more, in N. Amer., Asia and Austral., most of them not known horticulturally. In some of the *lespedezas* there are 2 kinds of fls., —petal-bearing and mostly sterile, apetalous and mostly fertile. There are a number of native *lespedezas*, usually of dry lands, some of which are offered by dealers in native plants, but they are not very showy and are most in place in natural borders and in amateur collections. These species thrive in light, dry soils. Because of the grayish or brownish color of the foliage, they are sometimes useful in landscape gardening work, and they are hardy, and of easiest cult.; perennial. Two or 3 of the oriental species are now becoming popular. *L. striata* is the Japan clover of the S., and is a valuable forage and green-manure plant. *L. bicolor* is a low shrub, with small violet-purple fls., hardy in New England, but little known in cult. The most important ornamental members of the genus thus far well known are *L. Sieboldii* and *L. japonica*, which are hardy herbs or subshrubs sending up many strong wiry shoots each year, and blooming profusely in Sept. and Oct. Their late bloom is very desirable. All *lespedezas* are of the easiest cult. wherever hardy. Usually increased by division of the clumps. *L. Sieboldii* is readily prop. by green-wood cuttings under glass.

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A. Occidental or native *lespedezas*: of upright or erect habit, not showy; stipules and fl.-bracts minute, subulate.

B. Fls. whitish or yellowish, all complete.

1. **hirta**, Ell. Erect, 2-4 ft. tall, silky-pubescent; petioles shorter than the lvs.; lfts. nearly orbicular to long-ovate; fls. in oblong or cylindrical heads on peduncles that usually exceed the lvs.; pod scarcely shorter than calyx, oblong-ovate, pubescent. Dry soils, New England to Fla. and West. Mn. 6:181. —There is a form with oblong lfts.

2. **capitata**, Michx. Much like the last, but petioles very short, lfts. narrow-oblong or oval, and the fl.-heads dense and short-peduncled (peduncles shorter than lvs.). Range of the above.



2134 *Lespedeza bicolor*. ($\times \frac{1}{2}$)

BB. Fls. purple or violet, or some of them apetalous.

c. Peduncles slender.

3. *violacea*, Pers. Two to 3 ft., only sparsely leafy and slightly pubescent: lfts. broad-oval or oblong: fls. small, in a loose cluster which is on a stalk usually longer than the lvs.: pod ovate. Dry places N. H., west and south.

4. *Nuttallii*, Darl. Two to 4 ft., villous: lfts. oval, oblong or nearly orbicular: fl.-clusters dense or even capitate, the stalk mostly exceeding the lvs.: pod oval. New England, west and south, in dry soil.

cc. Peduncles nearly or quite wanting.

5. *Stuevei*, Nutt. Mostly unbranched, 2-4 ft., very leafy, velvety-pubescent: petioles very short; lfts. elliptic, firm, woolly or velvety both sides or at least underneath: fls. in nearly sessile, axillary clusters or heads. Vt., south and west.

6. *frutescens*, Brit. (*L. Stuevei* var. *intermedia*, Wats.). Less pubescent or almost glabrous: petioles mostly longer; lfts. oval or oblong: clusters very short-stalked. Maine, south and west.

AA. *Oriental lespedeza*, grown for forage in the S.: of trailing habit: stipules and fl.-bracts conspicuous.

7. *striata*, Hook. & Arn. JAPAN CLOVER. HOOPKOP. Annual, somewhat pubescent, decumbent or erect, slender: lvs. small and very numerous, the lfts. oblong or obovate, and the petioles very short: fls. small, pink or purple, in axillary clusters. China and Japan.—The date of introduction to this country is not known; it was collected in Georgia in 1846. It is now extensively naturalized south of Washington and the Ohio River, growing on nearly all kinds of land. On light lands it makes dense mats, but on heavy lands grows 18-24 in. high. It is a good pasture- and hay-plant, and is useful for plowing under as a green-manure. It thrives on land which is indifferently prepared. Seed is sown early in spring, at the rate of 15-25 lbs. to the acre. It often yields 2 tons and more of hay to the acre. For pasturage in the S., it is sometimes sown with oats in the autumn.

AAA. *Oriental lespedezas*, grown as ornamental plants for the fls.: erect: stipules and fl.-bracts small: perennials.

8. *bicolor*, Turez. Fig. 2134. Shrub, with slender branches, becoming 6-10 ft. tall, slender and graceful, glabrous: lvs. on thin wiry stalks, mostly longer than the glabrous blades; lfts. oval to round-obovate, rounded at the apex, the terminal one 1-2 in. long: fls. small, purple, in simple or compound racemes, which surpass the lvs.: pod $\frac{1}{4}$ in. long, somewhat pubescent. Japan. G.F. 5:114 (where *L. bicolor* and *L. Sieboldii* are contrasted by J. G. Jack, and drawn by Faxon, and here reduced in Figs. 2134, 2135).—Hardy as far north as Boston, blooming in July and seeding freely. A white-fl. variety is advertised.

9. *Sieboldii*, Miq. (*Desmodium penduliflorum*, Oudem. *L. racemosa*, Dipp. *L. formosa*, Kochne. *L. bicolor* var. *Sieboldii*, Maxim.). Fig. 2135. Herb (shrub in warm regions), throwing up strong, wiry shoots each year from the crown: sts. angled, reddish or brown, hairy (at least above): lvs. dull above and light-colored and hairy beneath, the petiole usually somewhat shorter than the blade; lfts. elliptic-oblong-pointed: fls. twice larger than in the last (nearly $\frac{1}{2}$ in. long), rose-purple, drooping in very numerous long racemes, which at the top of the plant are paniced: pod nearly or quite $\frac{1}{2}$ in. long, pubescent. Japan.

G.F. 5:115. Gng. 1:23. R.H. 1873:210. J.H. III. 30: 15. G.C. II. 20:749. F.S. 18:1888. B.M. 6602 and Mn. 7, p. 69 (as *L. bicolor*).—Blooms in Sept. and hardy in Cent. New England. A very desirable late-blooming plant, making a large specimen with age. Does not often seed in the N.

10. *japonica*, Bailey (*L. Sieboldii* var. *albiflora*, Schneid. *Desmodium japonicum*, Hort., not Miq.). Very like *L. Sieboldii* and perhaps a form of it, but blooms a week or two later, has very numerous pure-white fls., much lighter colored herbage, usually nearly glabrous lvs. and sts., the lfts. broader and



2135. *Lespedeza Sieboldii*. ($\times \frac{1}{2}$)

less pointed.—Hardy as the last, and seems to seed more freely in the N.

Other Japanese and Chinese lespedezas may be expected to appear in the trade. See Franchet, R. H. 1890, pp. 225-227, for an account of W. China ornamental species, with picture of *L. Delavayi*, Franch., which grows 3-6 ft. high, with elliptic obtuse lfts., and deep violet to purplish black fls. in a terminal panicle.—*L. cyrtobotrya*, Miq. Shrub, to 6 ft. or more, glabrous or somewhat pubescent, with the habit of *L. bicolor* but less handsome: lvs. of the shoots long-stalked, oval to oval-oblong, rounded or slightly emarginate at the apex, 1-1 $\frac{1}{2}$ in. long, the middle lft. long-stalked: lvs. of the lateral flowering branchlets short-stalked, crowded and much smaller; lfts. all short-stalked, oval, emarginate, $\frac{1}{5}$ - $\frac{1}{4}$ in. long: fls. purple, $\frac{1}{4}$ in. long, in dense axillary clusters or racemes not exceeding $\frac{1}{2}$ in. length. Japan.—*L. macrocarpa*, Bunge (*Campylobotrys macrocarpa*, Rehd. *Campylobotrys chinensis*, Bunge). Shrub, to 6 ft.: lvs. long-stalked; lfts. oval to oblong, emarginate, glabrous above, silky-villous below, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, the middle one long-stalked: fls. purple, $\frac{1}{4}$ in. long, slender-stalked in axillary many-fl. stalked racemes to 3 in. long: pods glabrous, more than $\frac{1}{2}$ in. long. N. and Cent. China.—*L. sericea*, Miq. Suffrutescent, to 3 ft. high: lvs. crowded, rather short-stalked; lfts. short-stalked, linear-oblong to linear, rounded at the apex, $\frac{1}{5}$ - $\frac{3}{4}$ in. long, strigose beneath, minutely so above: fls. white, nearly sessile, $\frac{1}{4}$ in. long, in axillary dense clusters or in dense and short leafy racemes to 1 in. long: pod little over 1 line long. China, Japan.

L. H. B.

LETTESOMIA (John C. Lettson, 1747-1815, English physician and botanist). *Convolvulaceae*. About 30 species of scandent shrubs of Trop. Afr. and E. Asia, which may occur now and then in collections in Fla. Allied to *Argyreia*, differing in ovary 2-celled rather than 4-celled: lvs. alternate, undivided: fls. mostly purple or rose-color, in cymes or heads; corolla tubular to funneliform, the stamens exserted or included: fr. an indehiscent caps.

capitata, Miq. (*L. strigosa*, Roxbg. *Convolvulus capitata*, Vahl. *Argyreia capitata*, Choisy). A beautiful vine with handsome lvs. and deep pink fls.: strong climber, with hispid branches: lvs. cordate-suborbicular, short-acuminate, somewhat hispid, 5 in. long: fls. hispid without, capitate on peduncles 2-4 in. long; corolla 2 in. long. India, Java. Grown in S. Fla.

L. H. B.

LETTUCE. The lettuce plant is botanically *Lactuca sativa* (which see), which is probably derived from *Lactuca Scariola*. It is an annual with milky juice, and has been greatly developed for its root-leaves. These leaves, much enlarged and modified, comprise the most popular of the plant salads. It has been in cultivation for more than 2,000 years, according to De Candolle. The varieties are many; in 1889, "Annals of Horticulture" listed 119 varieties offered by American dealers. The two general forms are the head lettuces and the cluster or open-leaf lettuces (Figs. 2136, 2137). There are also spring lettuces and summer lettuces, the latter being developed to withstand more heat, for lettuce usually thrives best in the cool weather of spring. Of late years, kinds specially adapted to forcing have been secured, as the growing of the crop under glass has now assumed large proportions. See *Forcing*, Vol. III, p. 1255.

The lettuce plant is quite hardy to cold, comes quickly to edible maturity, is not much subject to disease or insect injury and, though it quickly succumbs to dry hot weather, is generally of the easiest culture. Even a farmer's wife, who, because of household cares, cannot take the time to plant a garden or even to gather and prepare a mess of peas or beans, can make and care for a planting of lettuce, and a few heads cut in the early morning and placed where they will be kept cool are a most appetizing addition to the noonday meal. From 1 to 2 yards of row to a person should yield an abundance for as long as a single planting is usable and a family supply may be grown in the smallest village yard or even on the back of a city lot; and, because of coming to the table in better condition, may be superior to any obtainable from the market.

Hundreds of different varieties and strains have been developed, varying greatly in habit of growth and character or product, ranging from those with but a few upright-growing narrow, smooth, thin leaves, and which soon shoot to seed, to those with many thick broad, smooth, crumpled or savoyed leaves, either clustered together, or overlaying each other so as to form a round head like that of a cabbage.

Varieties differ greatly in adaptation to cultural conditions, some giving fine returns when grown under glass but are hardly usable when grown in the open garden. They also differ greatly in color, tenderness and other qualities of the leaf. In some varieties, like the Prize Head, the leaf is mottled with red and brown and so tender that they are often so broken and torn apart by a heavy rain as to be unsalable, while the light green more tender-looking but really tougher leaves of a nearby planting of Grand Rapids are uninjured. There are varieties that form very broad white mid-ribs which, when the green portion of the leaf is cut away, make quite as beautiful salad for table decoration or to eat from the hand as the finest celery or witloof.

There are many forms of Cos lettuce that are seldom grown in this country because they do not thrive in our bright sunny days, but do much better in the cloudy weather of England, where our most popular American sorts are considered coarse and weedy. All varieties require for the best development well-drained but moist cool friable soil, and thrive best in cool moist weather. They cannot be grown to perfection in the

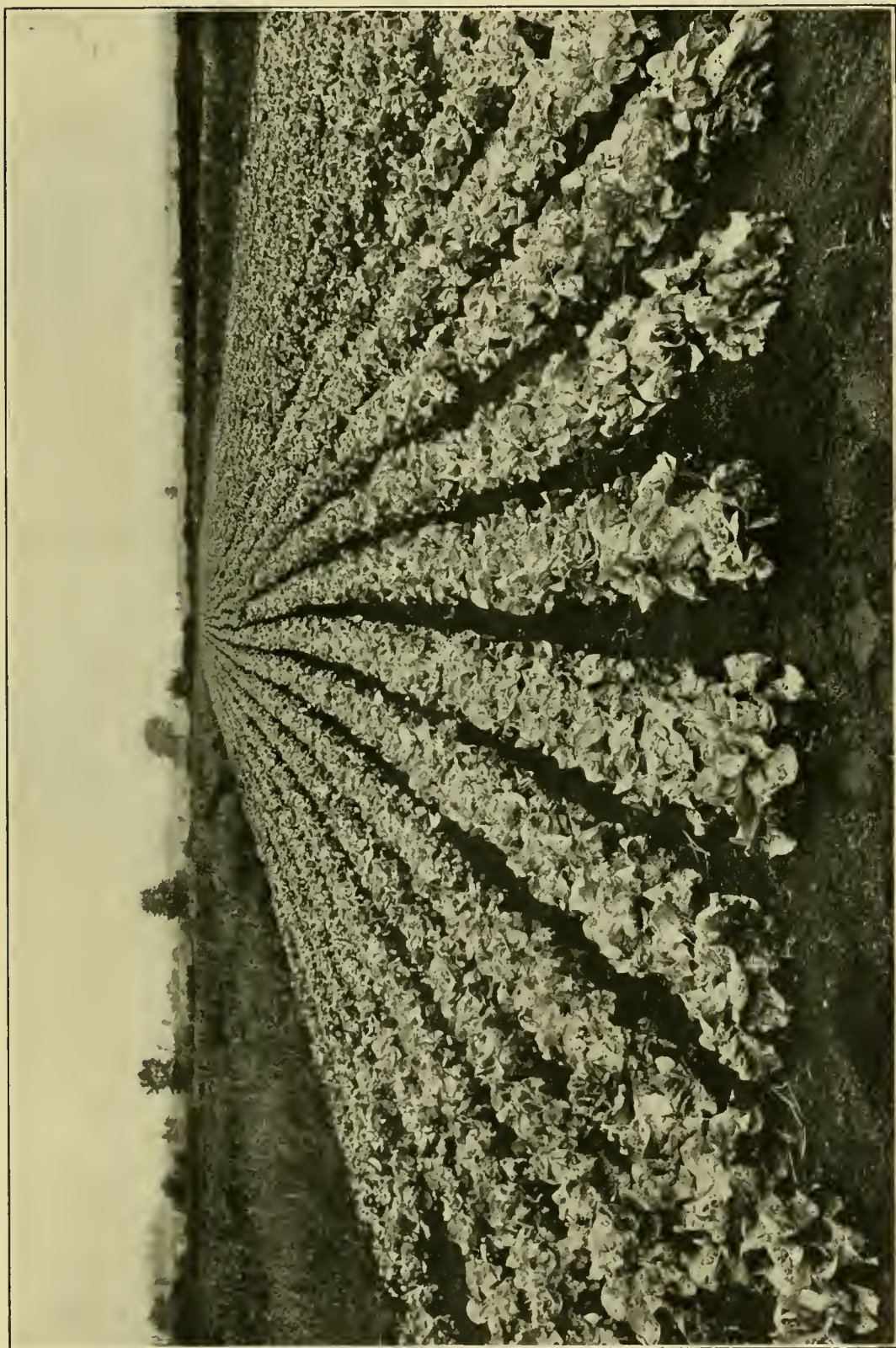
heat of midsummer. Even more than with many vegetables, it is essential to the most successful culture of lettuce that the soil be well enriched from previous dressings rather than recent applications, and if only coarse and fresh manure is available that it be well shaken apart, evenly distributed through, and well mixed with the soil. The most experienced Boston growers hardly expect a full crop until after the second or third manuring. Hardwood-ashes and bone-meal usually prove the most profitable



2136. Heading type of lettuce.

artificial manures. Plantings for the first crop can be safely made as early as the soil can be put in friable condition. In many lots of seed the outer seed-coats are very hard, resulting in slow germination, and it may be advantageous to soak the seed for twenty-four hours before planting. Drills about 16 to 24 inches apart and evenly about 2 inches deep should be made and while the soil is still fresh and moist twenty to forty seeds to the foot should be evenly distributed and covered with not to exceed $\frac{1}{2}$ inch of fine earth. Any greater depth, particularly on heavy soils, lessens the chances of a good and even stand. Some varieties are more sensitive than others to deep covering. Many successful growers in planting the Grand Rapids do not cover the seed at all except by washing over a little earth with a watering-pot and then shading with a board supported 1 or 2 inches above the row and removed as the plants germinate and start into growth. As the plants appear they should be thinned so as to prevent crowding and replanting should be made every fifteen to thirty days in order to secure a succession. With common facilities it is impossible to grow good lettuce in the dry heat of midsummer, though plantings in early autumn often furnish that of the very best quality.

In villages, plantings of lettuce for sale in the immediate vicinity often prove very profitable, the great essential to success being a rich well-drained soil, the



LXIV. A good field of lettuce.



2137. Clustering type of lettuce.

use of good seed of a suitable variety, the gathering of the crop in early morning when the leaves are cool and stiff and handling it with as little exposure to sunshine as practically possible.

In the recent years, hundreds of acres from Washington southward have been devoted to growing lettuce for shipment during the late winter and spring. In the northern sections, sash-covered frames with a single hot-water pipe along the front to guard against severe freezing are used. Farther south similar frames without provision for artificial heat but covered during the colder nights with sash and mats are used, and still farther south frames with only canvas curtains; or the crop is grown in sheltered fields with no artificial protection. All such plantings, however, are liable to become unpalatable or even killed by long-continued cold. The great essentials to success are a rich soil, even moisture, the fullest possible exposure to sunlight and first of all the use of pure seed of a variety like the Hubbard Market which is hardy and adapted to that cultural method and will stand shipment long distances and exposure in the market without loss of attractiveness.

The growing of lettuce seed.—In few vegetables is the satisfaction from a planting more dependent upon the varietal character and quality of the seed used, and fortunately the quality of most of that on the market is very dependable. Up to about 1865 most of the seed came from Europe, though comparatively small quantities were grown in Connecticut, New York and Michigan. About that time persons began to grow lettuce seed in California and the amount produced has increased until today not only the greater part of that used in America is grown there but large and constantly increasing quantities are sent to Europe. While small plantings of especial lots, of which little stock seed is available, are grown from started plants which are set in place in the field, the greater part of the crop is grown from seed sown in rows about 30 inches apart and the least typical plants pulled out until three to five plants to the yard are left. Many stocks grow such large and solid heads that they have to be pulled apart in order to let the seed-stalks shoot up, and often the lower leaves of the plant have to be pulled away to prevent the seed-stalk rotting at the base. As soon as the seed begins to ripen, the plants are cut and laid on large sheets onto which the earlier ripening seeds fall and the later ones are threshed off. The yield of seed varies greatly with the variety and the grower's success in securing it with little loss from birds or from shattering in the field and while harvesting, and commonly runs from 500 to 1,000 pounds to the acre. The growing of seed requires special experience and skill.

W. W. TRACY.

LEUCADÉNDRON (Greek, *white tree*). *Proteacea*. This genus includes the celebrated silver-tree of the Cape of Good Hope (see Fig. 2138), which has a striking and characteristic habit, and leaves densely covered with white silky hairs.

Shrubs or trees, all of S. Afr., above 60 in number: lvs. mostly narrow, sometimes even needle-like, entire, glabrous or silvery-tomentose, with a hardened apex: fls. dioecious, regular; male fls. usually many, in heads, each subtended by a bract and the head sometimes involucrate, the perianth-segms. separated to the middle or beyond, the anthers oblong or linear and sessile at the base of the perianth-limb; female fls. subtended by woody bracts and aggregated into cone-like heads, the perianth more deeply divided than that of the male fls., bearing narrow staminodia.

argenteum, R. Br. (*Prôtca argentea*, Linn.). SILVER-TREE. Fig. 2138. Branches densely

leafy: lvs. sessile, 3-6 in. long, $\frac{1}{2}$ - $1\frac{1}{4}$ in. wide, callous and blackish at the apex, lanceolate, acute, silvery white, and silky: involucre spreading, longer than the globular head of fls.: nut ventricose, turgid, wingless, the whole style and calyx persisting with it, obovate. B.R. 979. V. 5:282, 283. G.C. III. 6:725.—This tree grows wild on Table Mountain, Cape Town. In the early part of last century it was much used by settlers for firewood. It is said to grow poorly away from the Cape, except in S. Calif., where it does well outdoors. It is also rarely cult. in the E. in tubs, being protected in a cool greenhouse in winter and placed on the lawn in summer. The silver-tree attains

2138. Silver-tree.—*Leucadendron argenteum*.

30 ft. at the Cape, and in S. Calif. it has reached more than that height but is reported to be short-lived (25-30 years at the most). It is a very showy plant because of its silky somewhat compact foliage, and is worth growing for the juvenile state. Not difficult to start from seeds, but seedlings are very liable to damping-off, and the plants are said to transplant with difficulty in Calif. The tree needs good drainage. The dried leaves are sometimes used for decorative purposes. (See G.C. III. 6:714).

L. H. B.

LEUCÆNA (probably from Greek, *leukos*, white, referring to the flowers), *Leguminosæ*. This genus includes a tree known in southern Florida as the white popinac, a rapid grower, with acacia-like foliage and whitish flowers; it is also cultivated in S. California.

Trees or shrubs, usually unarmed, evergreen; lvs. alternate, pinnate, stipellate; fls. usually perfect, in close heads, not papilionaceous, the 5 petals being separate; calyx 5-lobed; stamens 10, not glandular, exerted; ovary stalked and style filiform; pod flat, broad-linear. Species 9 or 10. Mex., Guatemala, Peru, and Pacific Isls. The trees and shrubs of this genus have the habit of *Acacia*, but belong to the *Mimosa* tribe.

glauca, Benth. (*Acacia frondosa*, Willd. *A. glauca*, Moench. *A. buccophala*, Link. *Mimosa glauca*, Linn.). Spineless, tree reaching 30 ft. or more; pinnae 4-8-paired; lfts. 10-20 paired, oblong-linear to lanceolate, oblique, glaucous below; heads of fls. globose, to 1½ in. diam., white; petals erect, very narrow, about one-third as long as stamens; pod 5-6 in. long. Trop. Amer., but occurring in Fla. and Texas; naturalized widely in Old World.—It is cult. as an ornamental tree, and the young frs. and seeds are said sometimes to be eaten with rice; reported also to be used in certain regions as a forage plant for some animals.

L. trichodes, Benth. (*Acacia trichodes*, Willd.). Tree-like; pinnae 2-3 pairs; lfts. 3-5 pairs, ovate, acute; fl.-heads twin on axillary peduncles. S. Amer.

L. H. B.

LEUCÂNthemum (*white flower*). *Compositæ*. An old group-name for certain perennial herbs now included in *Chrysanthemum*. The most familiar species of the group is the common white-weed or "daisy" of the northeastern states, *Chrysanthemum Leucanthemum* (or *Leucanthemum vulgare* of former works). As distinguished from *Chrysanthemum*, the genus *Leucanthemum* differs chiefly in unimportant and inconstant characters of the achene.

LEUCHTENBÉRGIA (after Prince Leuchtenberg). *Cactaceæ*. AGAVE CACTUS. Stems in age forming a trunk 2 in. or more in diam., by the shedding of the

lower tubercles: tubercles triangular-acuminate, spreading, 2-4 in. long, ½-¾ in. wide, with twisted papery spines; fls. funnelform, widely expanded, borne near the apex of young tubercles; fr. gray, ovate-elliptical, 1 in. long, covered with scales and crowned by the persistent fl.; seeds dark brown, minutely tuberculate.—Only 1 species, closely related to *Echinocactus*, but of remarkably different form. The plant is readily grown in the manner of *Echinocactus* and *Mamillaria*.

principis, Hook. & Fisch. Fig. 2139 (adapted from Botanical Magazine.) Radial spines 6-8, the central one usually solitary, longer, sometimes 8 in. long; fls. yellow. B.M. 4393. A.G. 11:461.

KATHARINE BRANDEGEE.

LEUCOCÓRYNE (*white club*, alluding to the sterile anthers). *Liliaceæ*. About a dozen small bulbous plants of Chile, allied to *Milla* and *Brodiaea*, half-hardy in England, rarely planted here; they probably require the treatment given *ixias*. Plants scapose, with radical lvs., and tunicated bulbs or corns; fls. few, in terminal bracted umbels; perianth with 6 nearly or quite equal spreading oval-oblong or narrow lobes; stamens 6, of which 3 are perfect and the others reduced to staminodia; caps. membranaceous, 3-grooved, dehiscent. The species known to cult. are: *L. irioides*, Lindl. One foot; lvs. about same length; fls. 4-6, white or pale blue. B.M. 2382 (as *Brodiaea irioides*). B.R. 1293 (as *L. odorata*). *L. altiacea*, Lindl. Six to 12 in.: lvs. very narrow, 6-8 in. long; fls. pale lilac, ¾ in. long.

LEUCÓCRINUM (Greek, *white lily*). *Liliaceæ*. WHITE MOUNTAIN LILY. SAND LILY of Colorado. A bulbous plant growing a few inches high, with narrow foliage and clusters of pure white fragrant flowers borne just above the ground in early spring.

The fls. are funnel-shaped, having a slender tube 2-4 in. long, the greater part of which is below the surface, and 6 lobes, each ¾-1½ in. long, borne in clusters of 4 to many fls., and maintaining a succession for several weeks. They should be desirable for edging walks and bulb beds. They have a deep-seated rhizome and fleshy roots. The bulbs are procurable from Colo. and Calif., either as collected or nursery-grown stock. The genus has a single species. It belongs to an anomalous group, characterized by almost total lack of st. and fls. solitary or clustered among the radical lvs. From the other members of this group it is distinguished by the lvs. not 2-ranked, and an indefinite number of ovules in each locule. Perianth-segms. narrowly lanceolate, persistent; stamens 6; style persistent, slightly 3-lobed.

montanum, Nutt. Lvs. 8-12 or more, flat, rather thick, 4-8 in. long, 1-3 lines wide; pedicels ½-1½ in. long. Sandy soils and in mountain valleys, W. Neb. and S. Dak. to Colo., Ore., and N. Calif.

J. H. COWEN.

LEUCÓJUM (name discussed below). Also written *Leucobum*. *Amaryllidaceæ*. SNOWFLAKE. Hardy bulbous plants growing a foot or less high and bearing dainty, nodding, 6-parted flowers, which are white, tipped with green, yellow, or a tinge of red.

Perianth-tube none; segms. uniform, ovate or oblong, spreading; stamens epigynous; filaments filiform, shorter than the linear-oblong basifixed anthers; ovary 3-celled; ovules many in a cell, superposed; styles filiform or strumose near the apex; stigma minute, capitate; fr. finally dehiscent loculicidally into 3 valves from the top; seeds subglobose; testa usually black; rootstock a bulb, with membranous tunics; lvs. slender or lorate; fls. 1 or several in an umbel, white, tinged with red or green; spathe-valves usually single.—Eight species, natives of Eu. and the Medit. region, 6 of which are cult. The name *Leucojum* was given by Linnaeus, but he did not explain the application. The old Greek name, *Leucoion*, was given by Theophrastus to a plant now supposed to be a crucifer, like some stock or wall-



2139. *Leuchtenbergia principis*. ($\times \frac{1}{4}$)

flower. *Leucoion* is from *leukos*, shining, white, and *ion*, violet. Parkinson called it the "great early bulbous violet." Snowflakes appear about the same time as white violets, and sometimes have a delicate odor, resembling that of the violet.

Leucojums are best planted in dense groups, and allowed to remain undisturbed for a number of years. When bulbs are procured in the fall, plant immediately. Suitable for border, rock-garden or grass. Plant in a well-drained soil about 3 inches deep. Give a good winter protection. They are less popular than snowdrops (*Galanthus*), to which they are closely related, and have larger fls., with all the segms. of equal size.

A. *Blooming in March to early April.*

vérnum, Linn. (*Erinösmä vérnum*, Herb.). SPRING SNOWFLAKE. ST. AGNES' FLOWER. Bulb globose, $\frac{3}{4}$ –1 in. diam.: lvs. strap-shaped, finally 6–9 in. long, 4–6 lines wide; scape $\frac{1}{2}$ –1 ft. long, usually 1-fl.; perianth-segms. white, tipped green: seeds with a pale, membranous coat and conspicuous strophiole: fls. appear 1 month later than snowdrop. Cent. Eu., France to Bosnia and Tyrol. B.M. 46. G.C. II. 11:399; 21:341; 23:341. P.G. 5:47. Gn. 25, p. 335; 29, p. 607. V. 8:69. Var. *carpathicum*, Herb., has perianth-segms. tipped yellow. B.M. 1993. J.H. III. 32:169. G.M. 39:105. A choice form, usually bearing 2–4 fls. Var. *Vagneri*, Stapf. Early-flowering, with scapes usually bearing 2 fls. of which the green spots are of a darker shade. Hungary.

AA. *Blooming in April and May.*

æstivum, Linn. SUMMER SNOWFLAKE. Bulb ovoid, 1–1½ in. diam.: lvs. strap-shaped, 1–1½ ft. long, yellowish green: scape 1 ft. long, 4–8-fl.; perianth-segms. white, tipped green: seeds with a black, hard-shelled coat and no strophiole. Cent. and S. Eu. Mn. 9:45. P.G. 1:7. V. 3:342; 8:70. G. 5:185; 25:222. J.H. III. 55:253.

pulchellum, Salisb. (*L. Hernándezii*, Cambes.). Differs from *L. æstivum* by its smaller fls. and caps., narrower lvs. and fls. a fortnight earlier. Sardinia and Balearic Isles. Var. *majus* is a selected large-fl. form.

hyemäle, DC. Bulb globose, under 1 in. diam., with several membranous brown tunies: lvs. 2–4, contemporary with the fls., erect, narrow-linear, glabrous, 6–12 in. long: peduncle slender, erect, 1–2-fl.; perianth white; segms. oblong, imbricated, tinged with green on back and laxly many-veined, the 3 inner shorter and rather more obtuse than the 3 outer; stamens bright yellow, styles rather short: seeds black, punctate, furnished with a conspicuous fleshy white carunculus. Maritime Alps. B.M. 6711.—Blooms in April, rather than in winter as the name would imply.

AAA. *Blooming in autumn.*

autumnäle, Linn. (*Æcis autumnälis*, Salisb.). AUTUMN SNOWFLAKE. Bulb globose, $\frac{1}{2}$ in. diam.: lvs. thread-like, usually produced after the fls.: scape very slender, 3–9 in. long, 1–3-fl.; perianth-segms. white, tinged with red; stamens half as long as segms. Portugal and Morocco to Ionian Is. B.M. 960.—Not satisfactory in northern gardens. Prefers a sandy soil.

röseum, Martin. Bulb globose, $\frac{1}{4}$ – $\frac{1}{2}$ in. diam.: peduncle shorter and usually 1-fl.; perianth-segms. $\frac{1}{2}$ in. long, rose-red, oblanceolate; stamens $\frac{1}{2}$ in. long. Corsica.—Usually difficult to grow, and little known horticulturally.

WILHELM MILLER.
A. C. HOTTES.†

LEUCOPHYLLUM (Greek, *white leaf*). *Scrophulariaceæ*. Three spreading shrubs in Texas and N. Mex. with small alternate, elliptic to obovate entire lvs. covered beneath with silvery white wool: fls. axillary; calyx

5-parted; corolla campanulate or funnelform, with 5 rounded spreading lobes; stamens 4, didynamous, included, fixed at the base of the corolla; ovary 2-celled: caps. 2-valved; seeds many, oblong, wrinkled. Only the following species is cult. in S. Fla., and



2140. *Leucophyllum texanum*. (×12)

deserves cult. everywhere in the S. According to C. S. Sargent, "There is no shrub of the desert portions of the valley of the lower Rio Grande more generally distributed, and certainly there is not one of them which more delights the traveler in the early spring months, when the large, violet-purple flowers of this plant heighten the effect of its brilliant silvery foliage." G.F. 3:488.

texanum, Benth. Fig. 2140. Loose-growing, straggling shrub, 4 or 5 ft. high in the wild, 8–10 ft. high in cult.: lvs. $\frac{1}{2}$ –1 in. long, obovate, narrowed to the nearly sessile base: fls. violet-purple, campanulate, 1 in. long and as much across, hairy within. Spring and summer. G.F. 3:489 (adapted in Fig. 2140).

ALFRED REHDER.†

LEUCOPHYTA (*white plant*, a Greek compound). *Compositæ*. One species, *L. Bröwnii*, Cass., is offered abroad among coolhouse plants and is used in carpet-bedding for the white herbage. It is a much-branched rigid little white-woolly shrub (about 1 ft. high) from Austral.: lvs. alternate, linear, obtuse, very short and small (seldom $\frac{1}{2}$ in. long); heads small and collected in globular clusters $\frac{1}{3}$ – $\frac{1}{2}$ in. diam., the clusters surrounded by a few floral lvs.: pappus of 8–10 plumose-ciliate scales which are slightly united at the base. The plant is of easy cult.; prop. by cuttings. It may be wintered in a frame or coolhouse.

The genus *Leucophyta*, with its single species, is usually united with *Calceophalus*, the above plant then becoming *C. Bröwnii*, F. Muell. The two genera were founded by Robert Brown at the same time (Trans. Linn. Soc. XII: 106), but *Calceophalus* occurs first on the page. He separated *Leucophyta* because it differs in having a general involucre consisting of a few short bracts, in having the scales of the partial involucre concave and bearded at top, and in the pappus being plumose throughout its entire length.

L. II. B.

LEUCOSTEGIA (Greek, *white roof*; alluding to the indusia). *Polypodiaceae*. A small group of Indian ferns of small stature allied to *Davallia*, the indusium small, narrow, thin, attached by its base, with the apex and sides free. The lvs. are mostly tri-quadripinnate. For cult. consult *Davallia*.

parvula, Wall. Rootstocks wide-creeping, scaly: lvs. nearly sessile, deltoid, less than 1 in. long, half as wide, usually tripinnate. Singapore and Borneo.

L. M. UNDERWOOD.

LEUCÓTHOË (*Leucothoe*; daughter of Orchamus, king of Babylon). Including *Agarista*, *Ericaceae*. Ornamental shrubs grown chiefly for the handsome rather large usually evergreen leaves and the white flowers.

Evergreen or deciduous: lvs. alternate, short-petioled, serrate: fls. in axillary or terminal racemes; calyx 5-parted, imbricate; corolla ovate or cylindrical; stamens 10; anthers obtuse or 2-awned or 4-awned at the apex: caps. 5-lobed, with the sutures not thickened, separating into 5 valves; seeds minute, irregular. —About 35 species in N. and S. Amer., Madagascar, Himalayas and Japan, formerly often united with *Andromeda*, which differs like *Lyonia* chiefly in its valvate calyx.

The leucothoës, and particularly the evergreen species, are very handsome shrubs with rather large lustrous leaves and with white, rarely pink or scarlet, usually nodding flowers, appearing mostly in spring. The South American species, which are very rare in cultivation, though they surpass the others in beauty of the flowers, are hardly only South, while the other species can be grown as far north as Massachusetts and western New York, the evergreen ones in sheltered positions or with slight protection during the winter. They are very handsome for borders of shrubberies or as undergrowth in open woods. They thrive best in somewhat moist peaty or sandy soil, and prefer shaded or partly shaded situations, but also grow in full sun if the soil is not too dry.

Of the leucothoës, *Catesbæi* is one of the most ornamental and popular hardy broad-leaved evergreens. It is used for massing in connection with rhododendrons, kalmias, and the like, serving as a base for these taller plants. The shiny dark green leaves are borne with regularity on a recurved stem often 2 to 3 feet long, and sometimes color brilliant bronze and claret shades in autumn when exposed to the direct rays of the sun. *Leucothoe* sprays are largely used by florists in making up designs and in connection with galax leaves, usually, however, in the more informal pieces. They were introduced to the trade about 1890. The fragrant flowers are in the leaf-axils, borne along the stem in early spring, and are usually conspicuous, considering the fact that the leaves are persistent. It is this graceful evergreen spray effect, with the good color and dense habit, that makes leucothoe so desirable as a plant for massing, and also the fact, perhaps, that it is fairly easy to transplant. Seeds are produced freely, and can be sown in sphagnum moss and sand under glass, as rhododendrons and azaleas are grown, pricked off in flats and planted outdoors in early spring, when the plants are a few inches high. *Leucothoe* is also propagated by division, underground runners and cuttings, the latter being plunged in sand on the bench and given moderate bottom heat. It is usually collected, however, in its native habitat, in small plants, transplanted to nursery rows and grown for several seasons. (Harlan P. Kelsey.)

A. Lvs. evergreen: racemes axillary, sometimes clustered, shorter than the lvs.; anthers awnless.

B. Racemes dense, sessile, many-fl.: pith of branches solid. *axillaris*, Don (*Andrömæda axillaris*, Lam.). Shrub, to 5 ft., with spreading and usually recurving branches,

puberulous when young: lvs. with short pubescent petioles, oval to oblong-lanceolate, shortly acuminate, serrulate toward the apex, glossy above, pale and sparsely pubescent beneath when young, 2-4 in. long: racemes 1-2 in. long; sepals broadly ovate; corolla white, usually greenish in bud, $\frac{1}{2}$ in. long. April, May. Va. to Fla. and Ala. G.O.H. 114. B.B. (ed. 2) 2:687. G.W. 6, p. 279. Var. *longifolia*, Pursh. Lvs. linear-lanceolate. B.M. 2357.

Catesbæi, Gray (*Andrömæda axillaris*, Michx. A. *Catesbæi*, Walt.). To 6 ft., similar to the former, with glabrous, slender and more arching branches: lvs. longer-petioled, ovate-lanceolate to lanceolate, ciliate, appressed-serrate, glossy above, usually light green beneath, glabrous, 3-7 in. long: racemes larger; sepals narrower; corolla over $\frac{1}{4}$ in. long; white, usually reddish in bud. April, May. Va. to Ga. B.M. 1955. L.B.C. 14:1320. R.H. 1905, p. 577. G. 34:487. Gn.M. 2:18.



2141. *Leucothoe recurva*. ($\times \frac{1}{2}$)

—This species is handsomer than the former, and also somewhat hardier: lvs. and fl.-buds assume a beautiful purple hue late in fall which is retained through the winter.

113. Racemes peduncled, with rather few, slender-pedicelled fls.: pith lamellate.

populifolia, Dipp. (*L. acuminata*, Don. *Andrömæda acuminata*, Ait. A. *populifolia*, Lam.). Shrub, to 12 ft., with spreading branches: lvs. short-petioled, ovate-lanceolate, acuminate, entire or obscurely serrulate, glabrous, 2-4 in. long; pedicels as long as corolla; calyx very short; corolla cylindrical, over $\frac{1}{2}$ in. long. June. S. C. to Fla.

AA. Lvs. deciduous: racemes mostly terminal, secund, longer than the lvs.; anthers awned. (Subgenus *Eubotrys*.)

racemosa, Gray (*Andrömæda racemosa*, Linn. *L. spicata*, Don. *Lyonia racemosa*, Don). Shrub, to 10 ft., with mostly erect branches: lvs. oblong to ovate, acute, serrulate, pubescent beneath, at least on the veins, 1-3 in. long: racemes erect, 2-4 in. long; corolla cylindrical, $\frac{1}{2}$ in. long; anthers with 4 awns. April-June. Mass. to Fla. and La. Em. 423. G.O.H. 57.

recúrva, Gray. Fig. 2141. Similar to the last, but lower and more spreading; lvs. elliptic-ovate to elliptic-lanceolate, acuminate; racemes spreading and recurved; anthers with 2 awns; caps. depressed and strongly lobed. April-June. Va. to Ala. G.F. 9:225 (adapted in Fig. 2141). I.T. 1:40.—It grows in drier situations; the foliage of this and the preceding species assumes a splendid scarlet color in fall.

L. Davisia, Torr. Evergreen shrub, to 5 ft.; lvs. oblong, obtuse, crenately serrulate; racemes slender, many-fl'd., clustered in terminal panicles. May, June. Calif. B.M. 6247.—*L. Grayana*, Maxim. Half-evergreen; lvs. large, broadly oval, appressed-pilose; racemes terminal, slender; fls. rather small. June. Japan. Tender.—*L. neriofolia*, DC. (Agarista neriofolia, Don). Evergreen, glabrous shrub, with ovate-oblong, acuminate lvs. and bright scarlet fls. in erect, slender racemes at the end of the branches. Brazil. B.M. 4593. J.F. 2:155.—*L. pulchra*, DC. (Agarista pulchra, Don). Evergreen shrub, 2 ft. or more high, glabrous; lvs. ovate, mucronate, about 1 in. long; fls. white, in spreading, peduncled, slender racemes, much longer than the lvs. Caracas. B.M. 4314.

ALFRED REHDER.

LEÚZEA (De Leuze, friend of DeCandolle, who founded the genus). *Compositæ*. A few perennial or biennial herbs with simple 1-headed sts., one of which is sometimes planted in herbaceous borders or rock-gardens. By some the genus is referred to *Centaurea*, becoming a section of that genus distinguished by the feather-like pappus in several rows and which is connate at base and falls as a ring. Plants unarmed; lvs. radical, or alternate if cauline, dentate or pinnatifid, white-tomentose beneath; fls. purple, in large and showy heads, the corolla regular or slightly oblique, the tube long and slender; style-branches very short; involucre ovoid or subglobose, the bracts in many series; heads homogenous.—Species probably 5 or 6, widely distributed; Eu., N. Afr., Austral.

conifera, DC. (*Centaurea conifera*, Linn.). Small plant, 4-12 in. high, blooming in June and July, sometimes described as biennial and sometimes as perennial; lvs. lanceolate, tomentose beneath, entire or pinnatifid; involucre-scales glabrous; st. simple, 1-headed. S. Eu.

L. II. B.

LEVISTICUM (origin of name obscure; thought to be a corruption of *Ligusticum*). *Umbelliferae*. *LOVAGE*. Perennial grown for its aromatic seeds, which are used in confectionary. The genus has only one species, and is distinguished by having a conspicuous involucre of narrow deflexed bracts, prominent involucre with connate bractlets, strongly ribbed fr. with solitary oil-tubes, obscure calyx-teeth, green-yellow petals, and large bipinnate lvs.

officinale, Koch (*Hipposelinum Levisticum*, Linn.). *LOVAGE*. Tall; lvs. dark green, shining; segms. wedge-shaped at the base, cut toward the apex; fr. 3-ribbed, hollow and boat-shaped or else flattish on one side, convex on the other. S. Eu., sometimes escaped in N. Amer.—The lf.-stalks were formerly blanched and eaten like celery. It is a tall, hardy perennial herb, with large, 2-3 times divided radical lvs. The plant may be prop. by seed sown as soon as ripe, but when plants are already established root-division is less troublesome and risky. Division may be made in the autumn, but better in the spring. The divided plants and the seedlings, when 2 or 3 in. tall, should be set in checks 3 ft. apart in deep, rich soil. When well established the plants remain profitable for many years, demanding but little attention.

L. II. B.

LEWISIA (named by Pursh for Capt. Meriwether Lewis, of the Lewis and Clark transcontinental expedition). *Portulacaceæ*. Fleshy-leaved low perennials, bearing showy white, rose or red flowers.

Plants acaulescent or nearly so, with thick and farinaceous caudex and root; lvs. narrow, mostly clavate or spatulate or oblong, entire, rosulate at the apex of the short caudex (or corm in one species); fls. 1 to many, on scapes, often large and handsome; sepals 2-8, persistent; petals 3-16; stamens 5 to numerous, the anthers oblong

to linear; style-branches slender, 3-8, with long stigmatic surfaces; fr. a circumscissile caps.; several to many-seeded.—Species about a dozen, from Colo., Wyo., and Mont. westward. The genus has been variously defined; as here characterized, it includes *Oreobroma* and species that have been described under *Calandrinia* and *Talinum*. From *Calandrinia*, the genus is separated by style-branches often more than 3, and caps. circumscissile near the base rather than 3-valved from the apex. The cultivator's interest in *Lewisia* centers chiefly in *L. rediviva*, which is grown in collections of succulents. The other species are very little known as cult. plants, although there appears to be an accelerated interest in them in recent years. They should make good rock-garden and alpine subjects. See *Succulents*.

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A. Sepals, or sepal-like bracts, 4-8.

1. *rediviva*, Pursh. BITTER-ROOT. Lvs. linear-oblong and nearly terete, densely clustered, glaucous and smooth; scapes little longer than the lvs., jointed at the middle where there are verticillate bracts; fls. rose-color or white. June-Aug. Mont. and north, to Ariz. and west.—It is the state flower of Montana. The bitter-root has an interesting history. It has been tested in the E., and is desirable for rockeries, needing perfect drainage, a sunny position and careful watering while in flower. It is one of those perennials that should be planted in groups for best effect, and also as a precaution to prevent loss by oversight in careless weeding during flowerless period. The starchy root is dug by the Indians in spring, and eaten. The bark is ordinarily very bitter, but at flowering time it is said to slip off easily, and the root when boiled has little of the bitter taste. The roots from which the plant was first described showed signs of life after being in the herbarium for several years. Pursh planted them, and they grew for a year. This event suggested the name *rediviva*. The fl. figured in B.M. 5395 came from a root which has been immersed in boiling water in order to make an herbarium specimen. The root is called spatulum or spatum by the Indians. A full account of this plant is given by Paillex & Bois in *Le Potager d'un Curieux*. Also in R.H. 1892, p. 298. B.M. 5395. V. 2:306. Mn. 2, p. 85.

AA. Sepals 2, without subtending bracts. (*Oreobroma*.)

B. Root a small corm.

2. *triphylia*, Rob. Sts. slender, 1 to several from a globular corm $\frac{1}{4}$ in. or less thick (differing from *Claytonia* in the circumscissile caps.), the plant 4 in. or less high; st.-lvs. 2 or 3, linear and sessile; fls. white, in an umbel of 3-20 or more, the scape partly underground. Subalpine, Colo., west and north.—Apparently not offered.

BB. Root-part a more or less vertical caudex.

C. Lvs. narrowly linear.

3. *minima*, Nels. Lvs. few to several, 2 in. long, more or less, narrow-linear, usually exceeding the scape; fls. white; sepals about oval, with a short point and sometimes 1 or 2 lateral teeth; scape with a pair of small bracts toward the base. Yellowstone Park.—Offered in Colo.

CC. Lvs. broader than narrowly linear, usually more or less spatulate (perhaps an exception in No. 9).

D. Scape 1-4-fl'd.

4. *Tweedyi*, Rob. (*Calandrinia Tweedyi*, Gray. *Oreobroma Tweedyi*, Howell). Lvs. 2-4 in. long, obovate, mostly shorter than the 1-3-fl'd. scapes; fls. pink, 2-3 in. across; sepals orbicular, entire; stamens

10 or 11; seeds granulate and arillate. Alpine, Wash. B.M. 7633. Gn. 59, p. 387; 64, p. 28. G.M. 46:335. G. 36:444. F.S.R. 1, p. 145.

5. *oppositifolia*, Rob. (*Calandrinia oppositifolia*, Wats. *Oreobroma oppositifolia*, Howell). Lvs. linear-oblanccolate to linear, 1-3 in. long, sometimes 1 or 2 pairs on the lower part of the scape; fls. 2-4, white or pale pink, on long pedicels; sepals roundish, denticulate at apex; stamens about 12. Calif., Ore.

6. *pygmæa*, Rob. (*Calandrinia pygmæa*, Gray. *Oreobroma pygmæa*, Howell). Lvs. broad-linear to spatulate or lance-oblong, mostly shorter than the scapes; fls. 1-2, rose-red; sepals somewhat truncate and erose; petals 6-8, and stamens about the same number. Alpine, Rocky Mts., Sierra Nevada, and Cascades.

DD. *Scape mostly several- to many-fl.*

7. *Cotylêdon*, Rob. (*Calandrinia Cotylêdon*, Wats. *Oreobroma Cotylêdon*, Howell). Lvs. obovate-spatulate to orbicular, in a dense rosette; scapes several, to 10 in. high, bearing a panicle; fls. white, the 7-10 obovate or oblanceolate petals pink-veined down the middle; sepals roundish, denticulate; stamens 6-9. Mountains, N. Calif. B.M. 8220. G.C. III. 43:342; 49:337. Gn. 72, p. 290. G. 36:445.—Attractive, with its basal rosette and its red-lined fls. standing well above the lvs.; produces offsets.

8. *Howellii*, Rob. (*Calandrinia Howellii*, Wats. *Oreobroma Howellii*, Howell). Lvs. oblong to ovate, flat, with thin crisped margins, forming a rosette; fls. deep rose-color, in short racemose cymes; sepals orbicular to broad-ovate; petals 7-10, oblong-lanceolate, emarginate or entire; stamens 7. S. W. Ore. G.C. III. 51:349. Gn. 78, p. 400. G. 36:445.

9. *Leana*, Rob. (*Calandrinia Leana*, Porter. *Oreobroma Leana*, Howell). Lvs. linear, somewhat terete, sometimes subspatulate, 1-2½ in. long, glaucous, tufted; fls. many, in a panicle, the scapes bearing a few scattered bracts; fls. red to white, with darker veins; sepals ovate or roundish, fimbriate; petals 5-7; stamens 4 or 5. Mountains, N. Calif., Ore.

10. *columbiâna*, Rob. (*Calandrinia columbiâna* and *Oreobroma columbiâna*, Howell). Lvs. numerous, linear-spatulate, flat, not glaucous, 1-2 in. long; fls. white or pink with dark red veins, few to many in a panicle; sepals rounded or truncate; petals 4-7, oblong, toothed, emarginate or entire. Columbia River and Cascades.

L. H. B.

LEYCESTÈRIA (Wm. Leycester, judge in Bengal). Including *Pentaptyxis*. *Caprifoliaceæ*. Himalayan and Chinese small shrubs with whorled small flowers, suitable for mild climates.

Deciduous: lvs. opposite, simple, the stipules very small or none; fls. in erect or drooping verticillate leafy-bracted spikes; calyx persistent, unequally 5-lobed; corolla funneliform, nearly equally 5-lobed and swollen at the base; stamens 5, on the corolla-tube; ovary 5-7-angled, the stigma capitate; fr. a berry, sometimes eaten by birds.—Species about 4, only one of which appears to be in the trade; prop. by seeds and by cuttings. The genus is allied to *Lonicera*, from which it differs in its nearly regular corolla, and fr. with more locules; and to *Diervilla*, which differs in 2-loculed caps.

formôsa, Wall. (*L. elegans*, Hort.?). Strong-growing, with fistular (hollow) branches, 6 ft.; lvs. broadly ovate to ovate-lanceolate, acuminate, entire or toothed, more or less puberulous beneath; fls. purplish, fascicled in whorls in drooping leafy spikes or spike-like racemes; fr. dark red, subglobose. Himalaya, 5,000-10,000 ft., to W. China. B.M. 3659. G.W. 7, p. 355. B.R. 25:2. M.D.G. 1908:330. Gl. 28, p. 181. R.H. 1857, p. 109. Grown in England and apparently in Calif. Var. *variegata*, Hort., has variegated foliage. Var. *rosea*, Hort., has rose-colored fls.

L. H. B.

LHÓTZKYA (Dr. John Lhotzky, botanical traveler in Australia, and elsewhere). *Myrtaceæ*. Heath-line Australian evergreen shrubs of 10 species, rarely grown under glass. Lvs. small, scattered or opposite, entire and rigid; fls. sessile or nearly so, solitary or in leafy heads, white, yellow, pink or purple; calyx with an elongated ribbed tube and 5 broad very obtuse lobes; petals 5, entire and spreading; stamens many, in several rows. *L. acutifolia*, Lindl., has white or yellowish fls.

and linear mucronate lvs. 1½-2 in. long. *L. cricoides*, Schauer, has white or whitish fls. and slender short linear 3-angled lvs.; erect, nearly glabrous, the fls. being in fascicles midway of the leafy branchlets. B.M. 7753. *L. violacea*, Lindl., has purplish fls. and oblong very obtuse short lvs.

LIATRIS (a name of unknown derivation). Syn. *Lacinaria*. *Compositæ*. BLAZING STAR. BUTTON SNAKE-ROOT. Hardy perennials, confined to eastern and southern North America, best adapted to the wild-flower border.

They are erect often resinous herbs, simple or branched, and arising from a tuber: lvs. alternate, narrow, 1-5-nerved; fls. in racemose or spike heads; receptacle flat, or slightly convex, naked; corolla regular, its tube slender and 5-lobed.—Twenty-five or more species.

The most showy are *L. elegans* and *L. pycnostachya*. All produce flowers in wand-like spikes or racemes, the petaloid coloring of the involucre bracts often adding to the effect of the usually bright rose-red or purple flowers. Their flowers are produced in late summer and autumn. They multiply by offsets from their corn-like base, or may be grown from seed, which should be sown in autumn. They will grow and produce flowers in poorer soil than most garden plants, but thrive best in good, rich garden soil, and require no



2142. *Liatris spicata* var. *montana*. (×1½)

special care. When grouped in masses they give best results. They are scarcely domesticated as yet.

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A. Involucre-bracts obtuse.

B. Heads hemispherical, ½-1 in. broad, 15-45-fl. and peduncled.

1. *scariosa*, Willd. St. stout, 1-5 ft. high; lower lvs. spatulate or oblong-lanceolate, 4-6 in. long, ½ in. wide; upper narrowly lanceolate; heads large, numerous, in a relatively loose spike; involucre bracts often tinged with purple; fls. purple; pappus bristles minutely bar-

bellate. Throughout the U. S. and Canada, east of the Rocky Mts. B.M. 1709. B.R. 590 and 1651. G.C. III. 14:593. P.M. 5:27 (as *L. borealis*).—Next to *L. elegans* and *L. pycnostachya*, perhaps the most desirable species for ornamental purposes.

BB. Heads oblong, 3–4 lines broad, 5–15-fl'd.

C. Bracts not punctate.

D. The heads sessile.

2. *spicāta*, Willd. St. stout, rather tall, 2–5 ft., and very leafy: lvs. all linear, the lower larger and broader than the upper, which are gradually reduced to the linear-subulate bracts of the spike: heads 8–13-fl'd., $\frac{1}{2}$ in. long, closely sessile, and forming a dense spike from 6–12 in. long; involueral bracts rounded obtuse, with usually purplish margins. In the Atlantic and Gulf States, from Mass. to La. G.W. 14, p. 299. B.M. 1411.—Useful for low situations or along streams.

Var. *montāna*, Gray (*L. pumila*, Lodd.). Fig. 2142. Lower, 10–20 in. high: lvs. broader, the lower ones $\frac{1}{2}$ – $\frac{3}{4}$ in. broad, and obtuse at apex: spike proportionately short and heads larger, the fls. blue-purple. Va. and N. C., in the mountains. L.B.C. 2:147.

DD. The heads distinctly pedicelled.

E. Lvs. oblong-lanceolate, relatively short.

3. *gracilis*, Pursh (*L. pauciflosculosa*, Nutt. *L. lanceolata*, Bertol.). St. slender, 1–3 ft. high: lower lvs. oblong-lanceolate, upon distinct petioles, upper reduced to small linear bracts: heads in a loose raceme, 3–5-fl'd., purple; bracts of the involuere few and rather loose. Ga., Ala. and Fla.

EE. Lvs. attenuate-linear, the radical 8–12 in. long.

4. *tenuifolia*, Nutt. (*L. levigata*, Nutt.). St. slender, 2–4 ft. high: lvs. without distinction of blade and petiole, only a line or two wide: heads in a strict raceme, a foot or more long, about 5-fl'd., purple; pappus strongly barbellate. N. C. to Fla.—Suitable for dry sandy borders.

CC. Bracts punctate: heads peduncled.

5. *graminifolia*, Pursh. St. comparatively slender, 2–3 ft. high, striped with light green lines: lvs. ciliate toward the base, with scattered hispid hairs: spike less dense, often becoming racemose; head $\frac{1}{2}$ in. long; bracts of involuere punctate, rounded at the apex. Atlantic States, Va. to Fla.—Adapted to a light dry soil. Considered by some to be a mere form of *L. gracilis*.

AA. Involuere-bracts acute or mucronate.

B. Heads 15–60-fl'd., cylindrical or turbinate.

C. Bracts with lanceolate, spreading, rigid tips.

6. *squarrōsa*, Willd. St. stout, 6–20 in. high: lvs. linear and rigid, the lower elongated and grass-like: spike variable in length, bearing few to many heads, the larger heads 1 in. long; fls. bright purple; involueral bracts lanceolate, rigid, and usually bearing pointed tips, squarrose. E. U. S., as far west as Neb. and Texas. B.R. 948 is var. *intermedia*, of this species.

CC. Bracts with closely appressed, mucronate tips.

7. *cylindrācea*, Michx. St. 1 ft. high: lvs. and spike as in last species: heads few, 16–20-fl'd.; bracts of involuere abruptly mucronate. Upper Canada to Minn. and Mo.

BB. Heads 3–6-fl'd., oblong or narrowly campanulate.

C. Inner bracts much longer than the fls.

8. *élegans*, Willd. St. 2–3 ft.: lvs. linear, the upper soon reflexed: spike dense and wand-like, 3–20 in. long; heads $\frac{1}{2}$ in. long; inner involueral bracts prolonged into spreading, petaloid appendages, which surpass the fls. and pappus; fls. and petaloid appendages purple, showy. Va., to Fla. and Texas. B.R. 267.—Especially adapted for dry sandy situations.

CC. Inner bracts not longer than the fls.

D. Pappus bristles very plumose: bracts appressed.

9. *punctāta*, Hook. St. stout, 10–30 in. high: lvs. and involueral-bracts punctate and rigid: spike long and wand-like, dense and leafy; heads 4–6-fl'd., the fls. purple, $\frac{3}{4}$ in. long; bracts of involuere oblong, rather abruptly cuspidate, ciliate on its margins; pappus plumose. Sask. and Minn. to Texas and Mex.

DD. Pappus bristles merely barbellate.

E. Involueral-bracts spreading.

10. *pycnostachya*, Michx. St. stout, 3–5 ft. high: lvs. crowded throughout, the lower lanceolate, the upper narrowly linear: spike densely fld. 5–18 in. long; heads about $\frac{1}{2}$ in. long, all sessile; involuere with squarrose tips acute, purplish; pappus copious, minutely barbellate. Ill. and Iowa, to Ark. and Texas. R.H. 1883:324. Gn. 55:238. G.W. 6:169.—One of the choicest and boldest species.

EE. Involueral-bracts appressed.

11. *Chápmāni*, Torr. & Gray. St. a foot or two high, strict and rigid, white-velvety: lvs. short, the lower oblong-linear, the upper small and awl-shaped: spike densely fld., often 1 ft. long; heads about 3-fl'd.; fls. large for the size of the head, purple; pappus grayish, the bristles minutely barbellate, about $\frac{1}{2}$ in. long. Fla.

L. ligulistylis, A. Nelson. St. 16–20 in. high: lvs. bright green, glabrous, the lower lance-oblong: heads few to several, in a long raceme; fls. 50–70, purple; exerted style-branches conspicuous, flattened, as long as corolla, light purple. Colo., Wyo. to Dakotas.

W. W. ROWLEE.

N. TAYLOR.†

LIBÉRTIA (Marie A. Libert, a Belgian woman, who wrote on liverworts about 1820). *Fridæcæ*. Tender mostly white-flowered plants classed as bulbs and procurable from Dutch dealers.

Perennial herbs with a short creeping rhizome and long fibrous roots: lvs. linear, equitant; perianth without any tube above the ovary; segms. obovate, the 3 outer usually shorter, firmer and less showy than the inner, more or less green or brown; stamens inserted at the base of the segms.; filaments free or connate toward the base; ovules many, superposed: caps. small, leathery, loculicidally 3-valved; seeds 3-cornered.—The genus has 8 or 10 species, in Austral., New Zeal., Tasmania and Chile. Botanically it is near *Diplarrhena*, but in the latter the inner segms. are shorter than the outer ones and connivent. *Libertia* belongs in the same subtribe with the blue-eyed grass (*Sisyrinchium*), but in the latter case all the perianth-segms. are about equal in size. One species is blue-fl'd. The *libertias* should be acceptable outdoor subjects in the milder parts of the country. Prop. by division and seeds. They require plenty of moisture at the roots.

A. Fls. white.

B. Clusters lax: pedicels longer than the bracts.

pulchella, Spreng. Lvs. not rigid, 3–6 in. long, entirely green: st. $\frac{1}{2}$ –1 ft. long: infl. of 1 or few clusters, which are 2–3-fl'd.; segms. $\frac{1}{4}$ in. long, nearly equal, white. S. Austral., Tasmania, New Zeal.

ixioides, Spreng. Lvs. 1 ft. or more long, with a broad pale midrib: st. 1–2 ft. long: infl. an ample panicle with numerous peduncled, 2–6-fl'd. umbels; inner segms. orbicular-cuneate, white, the outer shorter tinged greenish brown: caps. broadly oblong or obovoid, $\frac{1}{3}$ – $\frac{1}{2}$ in. long. New Zeal.

grandiflōra, Sweet. Lvs. rigid, linear, 1–2½ ft. long, with pale midrib: st. 2–3 ft.: fls. rather larger than in *L. ixioides*, the inner segms. much larger and broader than the outer, white; caps. larger than in last, about the same shape. New Zeal. G.C. III. 43:2.—An excellent free-flowering plant.

inf. Clusters dense; pedicels shorter than the bracts. formōsa, Graham. Lvs. rigid, 1-1½ ft. long; st. 2-3 ft. long; infl. of many sessile and many-fld. umbels; inner segms. obovate-cuneate, ½-¾ in. long, white; outer segms. half as long and oblong, greenish brown; filaments connate toward the base; caps. globose. Chile. B.M. 3294. B.R. 1630. Gn. 45, p. 192 (fine habit sketch); 40, p. 441; 70, p. 175; 75, p. 545. G.M. 51:797; 55:92. G. 29:687.

AA. Fls. blue.

cærulēscens, Kunth. Lvs. linear, rigid, 12 in. or more long; st. 1-2 ft., with a few reduced lvs.; infl. 6 in. or less long, of very many umbels, each many-fld.; fls. blue; inner segms. ½ in. long, oblong, the outer much shorter and greenish brown; caps. globose, very small. Chile.

L. ntea, offered abroad, may be one of the white-fld. species above; described as having iris-like foliage and spikes of white fls.: 2 ft.

WILHELM MILLER.

L. H. B.†

LIBOCÉDRUS (*libas*, drop, tear, and *Cedrus*; alluding to the resinous character of the trees). Syn. *Heydéria*, *Pinácea*. INCENSE CEDAR. Ornamental trees chiefly grown for their handsome evergreen foliage and good habit.

Branchlets flattened, rarely quadrangular, frond-like in arrangement: lvs. scale-like, with decurrent base, with or without glands; fls. monoëcious or dioëcious, terminal, similar to those of *Thuja*; cones oblong to ovate, with 4, rarely 6, woody scales, the lower pair sterile, small and short, the second one much larger and fertile, each scale bearing 2 long-winged seeds, the third pair, if present, connate into a woody septum.—Eight species in W., N. and S. Amer., Austral. and S. W. China. Allied to *Thuja* which differs chiefly in the more numerous cone-scales with 2 pairs fertile.

The incense cedars are of pyramidal habit, clothed with small scale-like leaves, and rather small, ovate or oblong cones. None of the species is quite hardy North, but *L. decurrens* thrives in the vicinity of the city of New York, and even in sheltered places in eastern Massachusetts. It is a valuable park tree, forming a symmetrical narrow pyramid, with bright green foliage. It is also an important timber tree, the wood being light, soft, close and straight-grained, is very durable in the soil, and is used for fencing, for shingles, for the interior finish of houses, and also for ship- and boat-building. The other species are hardy only South, and, though very ornamental trees, they are hardly cultivated in this country; they are all important timber trees in their native countries. The incense cedars thrive best in a well-drained soil, and prefer open situations; they are liable to lose their lower branches rather early. Propagate by seeds sown in spring; also by cuttings under glass in late summer or fall, which root rather slowly; sometimes grafted on *Thuja* and *Chamaecyparis*.

decurrens, Torr. (*L. Craigiana*, Low. *Thuja Craigiana*, Murr. T. *gigantea*, Carr., not Nutt.). WHITE CEDAR. Tree, to 100, occasionally to 200 ft., with erect or spreading, short branches, forming a rather narrow, feathery head; bark bright cinnamon-red; branchlets much flattened, bright green on both sides; lvs. oblong-ovate, adnate, with long decurrent base, free at the apex and acuminate, glandular on the back; cones oblong, ¾-1 in. long, light reddish brown; scales mucronate below the apex, a third connate pair separating the 2 fertile ones. Ore. to Calif. and W. Nev. S.S. 10:534. F.S. 9, p. 19. Gn. 29, pp. 266, 267; 60, p. 250; 75, p. 296; 78, p. 586. G.C. III. 36:284; 44:338. M.D.G. 1905:129.—In cult. the young trees are conspicuous by their bright and deep green foliage, while the trees in their native localities are mostly of a light yellowish green. Var. *compácta*, Beissn. Dwarf compact form of globose habit. Var. *glauca*, Beissn. With

glaucous foliage. Var. *aureo-variegata*, Schwerin. Foliage variegated with yellow.

L. chilensis, Endl. Tree, to 60 ft., with compact, pyramidal head; branchlets much compressed; lvs. glaucous green, small, erect-spreading, obtuse, with a silvery line beneath; cones ovate-oblong, ½ in. long. Chile. G.C. 1850, p. 439. R.H. 1867, p. 410. Gn. 30, p. 552.—*L. cupressoides*, Sarg. (*L. tetragona*, Endl.). Tree, to 100 ft., with compact, pyramidal head, sometimes shrubby; branchlets almost tetragonal; lvs. ovate or ovate-lanceolate, with slightly spreading and acute apex; cones ovate; scales with a large, curved spine on the back. Chile to Patagonia. G.C. 1850, p. 439. Gn. 30, p. 552.—*L. Doniana*, Endl.=*L. plumosa*.—*L. macrolepis*, Benth. & Hook. Tree, to 100 ft.; branchlets compressed, green on both sides; lvs. acute, the lateral strongly keeled, the middle ones obovate, apiculate; cones obovate-oblong, 1 in. long, consisting of 6 truncate scales. W. China. Gn. 62, p. 183 (habit). G.M. 47:860. J.H. III. 57:91.—*L. pinnata*, Sarg. (*L. Doniana*, Endl.). Tree, to 100 ft., with dense, pyramidal head; similar to the former, but lvs. larger, more closely set and more spreading, without any silvery line beneath; scales of the cone with a large, curved spine on the back. New Zeal. This species is the most tender of this genus.—*L. tetragona*, Endl.=*L. cupressoides*.

ALFRED REHDER.

LIBONIA: *Jacobinia*; *Libonia floribunda*=*J. pauciflora*, page 1715.

LICUÅLA (Molucca name). *Palmæccæ*. Showy, dwarf fan palms, grown for their peculiar habit and handsome foliage.

Stems solitary or in groups, never very tall, and usually slender; lobes of the lvs. long, wedge-shaped, plicate, truncate and variously lobed or split, deeply and irregularly divided, appearing but not truly peltate; rachis very short; ligule short; sheaths fibrous; fls. large, hermaphrodite, in a loose panicle which appears among the lvs.—Species 50 or more, from Trop. Asia to Trop. Austral. Allied genera in cult. are *Brahea*, *Serenoa*, *Erythea*, *Pritchardia*, *Livistona*, *Trachycarpus*, *Rhapis*. From these *Licuala* is distinguished by the carpels of the ovary 3-angled, slightly coherent; style single, filiform; albumen equable; embryo dorsal. Desirable in cultivation. G.C. II. 25:139.

Licualas are very handsome warmhouse palms of moderate growth, several species of which have been grown to some extent commercially. They delight in a tropical temperature and abundant moisture, and should also be shaded from strong sunshine in order to produce foliage of the deep, rich shade of green that is common to this genus. Some advise treating them as semi-aquatic. The most attractive species is *L. grandis*, which has been until recent years a costly species owing to its comparative rarity in cultivation. It is probably within twenty-five years that the first consignment of seeds of this species was received in America. The large fan-shaped leaves of *licualas* are somewhat tender and easily injured, which makes them of less value for house decoration, but as exhibition plants there are few palms more striking than *L. grandis* and *L. elegans*. *L. spinosa* and *L. peltata* are also well worth cultivation, though objection is sometimes found to the strong hooked spurs with which their leafstalks are armed.



2143. *Licuala peltata*.

Propagation is by fresh seeds, over brisk bottom heat, preferably in pans. (W. H. Taplin.)

A. *Lvs. with lobes more or less grown together; lobes very broad.*

B. *Marginal teeth very large, the upper edges bent under.*

Rúmphii, Blume. Not unlike *L. spinosa*, but the petiole spiny below: segms. 12-15, the inner ones 2 ft. long and 1 ft. wide at the apex, the lateral ones 16 in. long and 4 in. wide, oblique; marginal teeth broadly ovate, obtuse, shortly bifid. Celebes and Borneo.—Cult. in S. Fla.

BB. *Marginal teeth with upper edges not bent under.*

grándis, Wendl. (*Prithárdia grándis*, Bull). Erect palm, the sts. clothed above with dead sheaths: lvs. very many, erect-spreading; petiole 3 ft., slender, glabrous, with stout, short, straight or curved spines along the margins below the middle; blade orbicular or semi-orbicular, very closely plicate, wedge-shaped or truncate at the base, concave, the margins with many short lobes which are obtusely 2-fid; ligule thick, short, acute, broadly ovate. New Britain Isl., north of New Guinea. I.H. 28:412 and 41, p. 82. G.C. II. 1:415. B.M. 6704. A.F. 7:1145. F.E. 7:982. S.II. 1:344. G. 10:439. R.B. 37, p. 24.

AA. *Lvs. digitately divided; lobes narrow.*

B. *Lobes less than 12.*

Jeanéneyi, Sander. A dwarf, rapidly growing palm: lvs. deep shining green; lobes blunt, 5-8. New Guinea. G. 55, p. 71. F.E. 11:291. G.M. 41:341. A.G. 22: 651.—This palm is known only in its sterile, young condition, and its relationship is in doubt. The name "Jeanéneyi" appears to be unknown in botanical literature. The plant is an attractive addition.

BB. *Lobes 12 or more.*

c. *Petioles without spines in the upper part.*

élegans, Blume. Sts. thick as a man's body, 4 ft. high, prominently scarred: petioles 3-4½ ft. long, the margins with brown hooked spines to just above the middle; lvs. orbicular; lobes very graceful, the linear-lanceolate lateral ones gradually decreasing to 11 in., obliquely truncate, with acute teeth, the middle lobes 16 in. long, truncate, with broader obliquely ovate obtuse teeth, lobes with only 2 or 3 folds. Sumatra.

cc. *Petioles spiny throughout.*

d. *Lvs. ascending.*

peltata, Roxbg. Fig. 2143 (redrawn from Martius). Lvs. 3-5 ft. diam., orbicular; lobes very variable in length and width, many-toothed at the apex, the teeth ½-2 in.; petiole stout, 3-4 ft. long. The lobes of the lvs. droop very gracefully. India. G.C. 1872:1657.

ámplifrons, Miq. Lvs. 2½ ft. long, the tip ascending: blade usually about 12-parted, many of the divisions 2-lobed at the apex: spadix long and stiff, reddish brown: fls. and fr. unknown. Sumatra.—Not common in cult.

DD. *Lvs. horizontally spreading.*

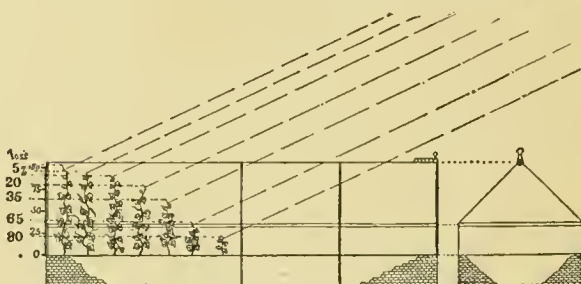
spinosa, Thunb. (*L. hórrida*, Blume). Lvs. 3 ft. or more diam., orbicular-reniform; inner lobes 18-22 in. long, 4½-5 in. wide at the apex, 10-11-toothed; outer lobes 15 in. long, 1½-2 in. wide, 4-6-toothed; teeth rather large, triangular-ovate, bifid; petioles obtusely 3-angled, 4-5 ft. long, with brownish hooked spines. Java, Moluccas.

JARED G. SMITH.
N. TAYLOR.†

LIDBÉCKIA (Eric Gustavius Lidbeck, Swedish botanist; published about 1750-1760). *Compositae*. Two S. African subshrubs or semi-herbaceous plants, sometimes grown in greenhouses and suitable for the open far S. Lvs. alternate, lobed or pinnatifid; peduncles 1-headed, the disk yellow and rays white; ray-

florets neuter; disk-florets perfect, tubular; receptacle flattish; bracts of involucre in 2-3 series: achene glabrous, wingless and without pappus but crowned by a cylindrical nectary. Prop. by seeds when procurable, and by cuttings. *L. lobata*, Thunb. (*Cótula lobata*, Hort. C. *quinqueloba*, Linn. f.), is silky villous, 1-2 ft. high: lvs. petiolate, 3-5-lobed, the lobes broad-oblong and mucronate: involucre very hairy. *L. pectinata*, Bergius, is glabrate or sparingly pubescent, 2-3 ft. high: lvs. nearly sessile, oblong, pinnatifid, glaucous beneath: heads larger than in the last, resembling *Chrysanthemum Leucanthemum*, the peduncles 1-3 in. long.

LIGHT. The various manifestations of energy which we term heat, light, electricity, gravitation, and the like, play an important rôle on living matter, and none is more important than light. Photosynthesis or carbon-assimilation, a characteristic plant function, constitutes one of the fundamental processes in nature; indeed this process, which in remote ages may have been developed secondarily as a protoplasmic function, is as wonderful as life itself, and a thorough comprehension of photosynthesis would appear to be as difficult as that of life. However, no form of energy affects plant configuration more than light, and in the growing of crops, whether



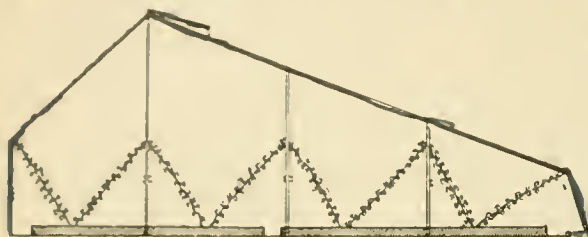
2144. Showing longitudinal and cross sections of a greenhouse with partitions running north and south, and illustrating the effect of poor light conditions. The oblique lines represent the path of the sun's rays.

out-of-doors or in the greenhouse, the factor, light, must always be given consideration.

Light is regarded as a form of radiant energy and is composed of various wave-lengths of exceedingly small size. Those which are especially active in photosynthesis or carbon-assimilation in our common green plants are in the red half of the spectrum, while the blue-green pigment organisms (marine algæ, and the like) utilize the more highly refrangible rays of the spectrum. Briefly, photosynthesis is the building up of carbohydrates from carbon dioxide and water through the chemical action of light on the chlorophyll, and since plants obtain most of their energy by means of this process, it is not difficult to realize its fundamental significance and importance. The ultimate product of photosynthesis is starch, but the complex chemical changes taking place in chlorophyll grains through the action of light and the building of starch from carbon dioxide and water is not definitely known, and there are doubtless many intermediate steps.

In any examination of flora is found much variation and adaptability to conditions, the result of innumerable generations existing under varied conditions. The light conditions in one section differ greatly from those in another part of the earth, but it is known from actual observation that some plants require much more light than others for their normal development. Even in the same location, such as the tropics, remarkable differences may be found in the light requirements. Many tropical plants require little light, and even when grown in northern latitudes in conservatories they require shading throughout the year. Palms, geraniums and other plants will develop normally under far less light

than such plants as the cucumber or lettuce, but the latter grow much more rapidly and may perhaps for this reason alone show the ill effects of poor light regardless of their photosynthetic requirements. Within certain limits, however, it can be stated that photosynthesis or carbon-assimilation is proportionate to light



2145. Showing cross section of an east and west house, about 36 x 200 feet, showing method of growing cucumbers. The light is much superior in a house of this sort.

intensity, and furthermore, that growth and development are correlated with photosynthesis.

The relation between photosynthesis and light intensity may be shown by using strong contrasting photographic negatives on leaves exposed to sunlight. By specially treating the exposed leaves, a positive can be produced which will show that little starch was formed under the thicker portions of the negative, and more under the thinner portions; in other words, the formation of starch under such conditions would be proportional to the amount of light received by the chlorophyll grains through the negative.

The general effect of light on growth is to retard it, though Blaauw, McDougal and Vogt have been able to discover a stimulation of growth under certain conditions, while, on the other hand, lack of light or darkness accelerates growth. The yellow rays of the spectrum are more active in inhibiting growth than the violet rays, the latter having a similar effect on plants to that of lack of light. Plants grow the most in the night, the growth curve gradually rising during the night and falling in the daytime. While lack of light stimulates growth, plants grown entirely in the dark or under poor light conditions are abnormal. Etiolated plants, or those grown in the dark, are devoid of chlorophyll, possess thin stems, elongated internodes and very poorly developed leaves. The mechanical or supportive tissue is little developed, and such plants possess small power of resistance. Light, on the other hand, develops mechanical tissue and induces firmness of texture. Moreover, without light there may be no increase in the weight of dry matter, hence seedlings grown in the dark may increase in size, but lose weight from respiration or loss of carbon dioxide.

Light is a factor in the dwarfing of alpine and arctic plants and in the development of hairs on some algae as a protection against too intense illumination. Some plants grown in a weak light fail to produce flowers. (Insects attracted by the warmth of the sun are more likely to visit flowers growing in sunshine than in the deep shade.) Many fungi (*Pilobolus*) do not produce fruiting bodies (sporangia) until they reach the light. Wiesner, who has made a thorough study of the light requirements of plants, has classified some of our common species as follows:

(a) Light-requiring: Alfalfa, red clover, wild carrot and so on.

(b) Light-loving: Dandelion, plantain, lychnis and so on.

(c) Indifferent: Blueberry, poet's narcissus, the common brake, and the like.

(d) Light-shunning: Forget-me-not, violet, anemone and the like.

(e) Light-fearing: Wild strawberry, water violet, and the like.

Wiesner found that the beech, for example, reaches its normal development in one-tenth part of the light intensity required by the larch and other sun-loving plants.

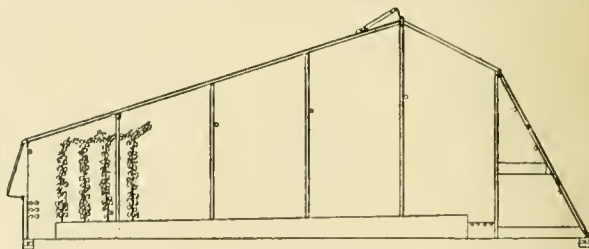
Light requirements are affected by a decrease in temperature; e.g., the maple in Norway requires ten times as much light as in Vienna for its normal development, and in general one may say, the farther north or the higher above sea-level a certain plant grows the greater becomes its light requirement.

The size of leaves is very much influenced by light. Too intense light as well as etiolation tends to reduce the size of the leaves, which reach their maximum in a medium light intensity. This is shown in the growth of such crops as cucumbers under glass during the winter.

Phototropism.

Phototropism or heliotropism is the term applied to the response of plants to a light stimulation from one side which causes movements toward or away from source of light. Phototropic movements are of much biological significance to the organism. Most aerial parts of plants (stems and branches) are positively phototropic, i.e., they bend toward the source of light, while roots are usually negatively phototropic, i.e., they bend away from light. For a clear understanding of the processes of plant response to light stimulation from one side, it is best to consider the reaction of a simple orthotropic plant such as the cotyledon of an etiolated oat seedling. This plant, which is remarkably sensitive, has been studied extensively by Darwin, Rothert, Fitting, Blaauw and others. It has been found in this plant that the apex of the cotyledon is the most sensitive to light stimulus, thus demonstrating, as in other forms of response, the localization of the perceptive or sensitive zone.

The bending toward the source of light as the result of the light stimulus begins at the apex, and it proceeds toward the base until the cotyledon coincides with the incident ray of light. The reaction time or latent period following stimulation is one-half to one hour in most cases, and the rate of transmission of the stimulus is from 0.7 centimeters to 1 centimeter an hour. The minimum time of exposure necessary to induce a reaction to a light stimulus is called the "presentation time," and this is dependent on the amount of light applied, which is a product of the light intensity, the exposure and distance from the plant. For example, an exposure to a light of high intensity (26,520 meter candle power) for one-thousandth of a second produced the same reaction as an exposure of forty-three hours to a light of very low intensity (0.00017 meter candle power).



2146. Showing cross section of a greenhouse used for lettuce and cucumbers. The slanting side toward the right (north) is boarded and used for forcing rhubarb. The cucumber plants are trained vertically.

An organ may be positively phototropic at one period of its development, and negatively phototropic at another, and it has been found that an oat seedling will respond positively and negatively or remain indifferent, depending upon the amount of light used. Many complicated forms of phototropism are observed in the

movements of leaves and flowers (begonia and sunflower) which adjust themselves to certain angles as regards the source of light.

Phototaxis and photonastic.

The reacting or orientating response of motile (bacteria, swarm spores, and the like) or free-moving organs (chloroplasts) to a unilateral light stimulation is called phototaxis. This is a common mode of light reaction in plants. Plant movements which are not dependent upon the direction of light stimulus but are due to changes in the intensity are called photonastic movements. Under this category may be placed the movements of stonata which open under illumination and close in the darkness, also certain movements of etiolated seedlings when subjected to light.

The pathological effects of light.

The pathological effects of light on plants are a much more important factor than is generally realized. Many pathological conditions of plants are brought about by lack of light, and in some cases excess of light may produce injurious effects. This is shown in the case of sun-scald, which occurs on various trees. Some plants are so perfectly adapted to forest conditions that they cannot endure direct sunlight without injury. When they are exposed to direct light such as is caused by forest thinning, they are likely to sun-scald badly, but more often difficulties arise from lack of light. Tissue developed under poor light conditions is more likely to be affected with winter-killing due to non-ripening of the wood, and burning from fumigation with gases is induced by lack of light in poorly lighted greenhouses. Lack of light during the dark months often develops inferior tissue, which, when exposed to the more intense light of spring, becomes susceptible to wilting. The exclusion of light from part of the plants resulting from crowding, often gives rise to various stem-rots such as are characteristic of parsley, water-cress, lettuce, and the like, and there are a large number of leaf-blights and spots such as occur on cultivated plants which are induced by insufficient light. Lack of light induces the formation of various mildews on plants and is conducive to damping-off in many cases. It often causes disease of plants growing in dry soil as a result of excessive transpiration; in short, every greenhouse grower must regulate the growth of his crops according to light conditions in order to eliminate the possibility of disease.

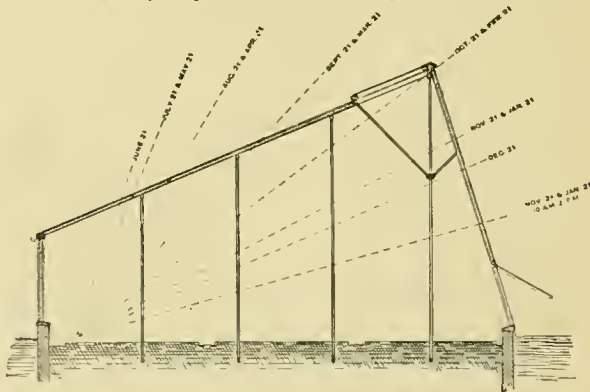
Light as a factor in greenhouse construction and management.

In the growing of plants under glass, which constitutes a large and constantly increasing industry, the problem of light is intimately associated with the location, construction of the greenhouses, management, and so on. Improvements in the line of greenhouse construction have been based very largely on the effects of light. The early houses in the United States were very crudely constructed, and in the modern, improved types of houses some crops are grown in one-half the time formerly employed, a fact due largely to improvement in methods of greenhouse construction. The old type of houses were chiefly sash-houses cumbered with shadow-producing material and glazed with small glass of inferior quality and often dirty, and widely lapped. The houses were in some cases so poorly constructed that they excluded from 40 to 60 per cent or more of light-rays. The modern house need not exclude more than 12 to 20 per cent. Some of the more or less modern types of houses which have been built for a number of years exclude as much as 30 per cent of light. Poor light conditions alone greatly retard growth, not to mention the frequent losses in poorly constructed houses from pathogenic organisms which find most favorable conditions for their development.

The amount of light to be found in any particular location depends upon the latitude, but more particularly upon the meteorological conditions which may prevail, and the variation in this respect throughout the United States is quite notable. Numerous meteorological observatories, without actually measuring the light intensity or amount of light, have given data as to the number of hours of sunshine, which is valuable in comparing light conditions in various localities. These records have been gathered for a considerable period of time and reliable averages are at hand. The average total number of hours of sunshine during the year based upon data covering a long period of time is as follows:

	Hours.
Chicago, Illinois.....	2,617
Cleveland, Ohio.....	2,000
Milwaukee, Wisconsin.....	1,865
Boston, Massachusetts.....	2,493
Nashua, New Hampshire.....	1,948
Ithaca, New York.....	2,273
New York, New York.....	2,510
Philadelphia, Pennsylvania.....	2,575
Phoenix, Arizona.....	3,742
Modena, Utah.....	3,354
Los Angeles, California.....	3,219

This data shows great variation in the hours of sunshine which cannot be attributed to latitude alone. It should be pointed out, however, that elevation constitutes a very important factor as regards light inten-



2147. Showing type of greenhouse constructed for obtaining the maximum amount of light in the short winter days. Dotted lines indicate position of sun at different periods of the day and year (at noon unless otherwise indicated). House 34 feet wide and 20 feet maximum height.

sity, the higher the elevation the better the light conditions, and even the light intensities at an elevation of 500 to 600 feet are better than those at the surrounding low country, at least during the early parts of the day, but this difference gradually decreases toward night. From the commercial florist's point of view, the critical months in the year are November, December, January and February, and even a few days of cloudy weather when the crop is maturing often make much difference in the financial returns. Much more variation in light intensity exists in the dark winter months than in other seasons of the year. This is true as regards the differences existing between morning and afternoon light, for during the darker months the light may average 30 per cent more intense during the morning than in the afternoon. The percentage of possible sunshine recorded during November, December, January and February averages 22 per cent for Cleveland, 44 per cent for Chicago, 54 per cent for New York, and 75 per cent for Los Angeles. From such variations in the amount of sunshine found in the various territories during the critical months, it is evident that there must be corresponding differences in the period of development of the crops, the growth of a crop being in general proportional to the amount of light it receives.

In the construction of greenhouses, therefore, it is important they should be designed to produce the maximum results during the critical light seasons. Theoretical diagrams are shown in Figs. 2144-8.

From a study of the light conditions in greenhouses, it has been found that large glass is superior to small glass because of the smaller amount of light-obstructing



2148. Showing type of greenhouse constructed to obtain the maximum amount of light in short winter days. Modification of type shown in Fig. 2147. Obstructs more light than Fig. 2147, but could be built wider.

framework, but with present methods of construction there is a limit to the size of glass that can be safely employed. Moreover, high-angled roofs are much superior to low roofs from the light point of view, but their practical utility is somewhat limited. Experiments with different types of glass have shown that there may exist 18 per cent difference in the light-transmitting properties of No. 1 and No. 2 quality glass, and third quality glass is 33 per cent less effective than No. 1 quality. A slight annual deterioration in greenhouse glass must be expected owing to the formation of a film of oil, but this can be obviated to some extent. The nature of the reflecting surface of the greenhouse, degree of lapping, and other factors influence light. In the modern large house more uniform light conditions are obtained than in the early, smaller houses.

As regards the direction of the greenhouse, for most purposes the east and west house is preferable for obtaining light, but some crops are able to thrive better, especially in the spring months, in a house running north and south. Morning light being superior to afternoon light, an east and west house should be tilted somewhat toward the northeast, thus exposing the plants more directly to the morning light and making it possible to syringe with less liability to fungous infection of the plants.

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LIGHTFOOTIA (Rev. John Lightfoot, 1735-1788, author of a flora of Scotland). *Campanulaceae*. Undershrubs or herbs (annual, biennial, perennial), of Afr. and Madagascar, with very small blue, white or pink fls.: lvs. usually alternate (sometimes fascicled or opposite), entire or toothed, small, narrow and rigid; fls. variously arranged; calyx-tube adnate to ovary, the

lobes persistent; corolla deeply 5-lobed or parted nearly to base, the stamens free; fr. a caps. dehiscing at the top. Species 40-50, Trop. Afr. to the Cape region. Two or three species are more or less mentioned in garden writings for greenhouse culture, but apparently none is in the trade. *L. tenella*, Lodd. (*L. ciliata*, Sond.), of the Cape, has erect woody branches and bluish racemose fls.: lvs. ovate-lanceolate, somewhat reflexed: 9 in. L.B.C. 11:1038. *L. subulata*, L'Her. (*L. sessiliflora*, Sond.). Lvs. very narrow, more or less spreading: st. ascending or erect, somewhat woody: fls. many, blue: 12-18 in. Cape. L. H. B.

LIGULÀRIA (name refers to the strap-shaped more or less bilabiate rays). Including *Farfugium* and *Erythrochate*. *Compositae*. Perennial herbs, some grown in the open for the striking flower-heads and leaves, but mostly indoors for the large and interesting foliage, or in summer bedding.

From *Senecio*, to which it is often referred, this genus differs largely in the character of the involucre, the scales or bracts of which are in one series at the insertion but of two forms so that the narrow outer ones overlap the edges of the broader inner ones; also in technical characters of the style. Lvs. mostly long-petioled, broad or even orbicular or reniform, sometimes palmate, those on the st. smaller and bearing large sheaths; heads large, reflexed or nodding, in corymbs or racemes; ligules or rays mostly long and narrow, usually yellow: achene glabrous, bearing soft pappus.—Species about 30, as now defined, from W. Eu. to Siberia, Himalayas and China-Japan. The plants impose no special difficulties in cult. They are prop. mostly by division.

Kaempferi, Sieb. & Zucc. (*L. Farfugium*, C. Koch. *Farfugium Kaempferi*, Benth. *Senecio Kaempferi*, DC.). Rhizomatous perennial sending up many lvs. on slender flocculent-woolly petioles: lvs. large (often 6-10 in. across), orbicular to nearly reniform, cordate at base, angular-toothed, green: fl.-sts. 1-2 ft. tall, flocculent-woolly, branched, with only small, bract-like lvs.: heads large, with light yellow rays spreading 1½-2 in. across; pappus white and copious. Japan. Var. **aureo-maculatus**, Hort. (*Farfugium grande*,



2149. Leopard plant, or Farfugium—*Ligularia Kaempferi* var. *aureo-maculatus*. (×½)

Lindl. *F. maculatum*, Hort.). LEOPARD PLANT. Fig. 2149. Differs in having the lvs. blotched with yellow or white and sometimes with light rose. B.M. 5302. The variety *aureo-maculatus* is the only form in general cult. It was intro. to England in 1856 "from the garden of a mandarin in the north of China" by Fortune. Years ago this was a common plant in conservatories and window-gardens, but of late years it has been neglected. It is, however, a most worthy plant, not only for the house but for bedding in the open in shady places. The plant is hardy as far north as Washington when set permanently in the open. One form has yellow-spotted lvs. (the commoner) and another has white-spotted lvs. Another form (var. *argenteus*) has lvs. glaucous-green edged with creamy white. Easily prop. by division.

japonica, Less. (*Arnica japonica*, Thunb. *Senecio japonicus*, Schultz. *Erythrochate palmatifida*, Sieb. & Zucc.). Strong perennial herb, growing 5 ft. high (said to reach 15 ft. in S. Japan), and grown for its massive foliage effect: radical lvs. very large, 1 ft. or more across, deeply palmately cut into 7-11 narrow-lobed and notched divisions: fl.-sts. branched, bearing heads on rather long, naked sts.; rays orange, spreading, 3 in. from tip to tip. Japan. Summer. Gn. 22, p. 139. J.H. III. 54:276.—Intro. into this country about twenty-five to thirty years ago. It is a bold plant, hardy in N. Y., and well adapted to planting where strong foliage effects are desired, provided the place is moist.

sibirica, Cass. (*Cineraria sibirica*, Linn. *Senecio sibiricus*, Clarke. *Ligularia racemosa*, DC. *Senecio Ligularia*, Hook. f.). Very variable, native from France to Japan: stout and erect, 3 to 4 ft.: lvs. to 1 ft. across, somewhat triangular to reniform or cordate-sagittate in outline, the basal sinus sometimes deep and sometimes shallow, obtuse or acute, the margin coarsely toothed, the petiole of the st.-lvs. winged and sheathing: heads many, each many-fld., somewhat secund in a terminal raceme; bracts of involucre 8-10; rays or ligules yellow, very long ($\frac{1}{2}$ - $\frac{3}{4}$ in.); pappus reddish.—May be planted in the herbary. Said to be a showy marsh plant.

macrophylla, DC. (*Senecio Lédebourii*, Schultz). Stout and erect, 3-6 ft.: lvs. very large, elliptic or oval-oblong, not sagittate or cordate at base, strongly toothed, long-petioled, sometimes 2 ft. long with petiole, those on the st. more or less clasping; heads yellow, in a long dense terminal spike or crowded panicle. Caucasus.—A striking and vigorous perennial. See *Senecio*, for another entry of this species.

L. II. B.

LIGUSTICUM (Latin, referring to the ancient province of Liguria). *Umbelliferae*. This includes a native hardy herb suitable for naturalizing with aquatics and bog-plants; offered by dealers in native plants. The ligusticums are glabrous perennials, with aromatic roots, large ternately compound lvs., mostly no involucre, involucels of narrow bractlets and white fls. in large, many-rayed umbels: fr. oblong or ovate, flattened laterally or not at all; oil-tubes 2-6.—Species about 20, in the northern hemisphere, of no horticultural prominence.

canadense, Brit. (*Ferula canadensis* Linn. *L. actrifolium*, Auth.). St. stout, 3-6 ft., branched above: lvs. 3-4-ternate; lfts. 2-5 in. long, coarsely serrate, broadly oblong; umbels 10-20-rayed; fruiting rays 1-2 in. long. July, Aug. Rich ground, S. Pa. to Ga. and Ala.

WILHELM MILLER.

LIGUSTRUM (ancient Latin name). Including *Viburnum*. *Oleaceae*. PRIVET. PRIM. Ornamental woody plants grown chiefly for their handsome foliage and the profusely produced white flowers; some species are excellent hedge plants.

Deciduous or evergreen shrubs, rarely trees: lvs.

opposite, short-petioled, entire, without stipules: fls. perfect, in terminal panicles; calyx campanulate, obscurely 4-toothed; corolla funnelform-shaped, with mostly rather short tube and with 4 spreading lobes; stamens 2: fr. a 1-4-seeded berry-like drupe.—About 50 species, chiefly in E. Asia and Himalayas, distributed south to Austral., one in Eu. and N. Afr.

The privets are much-branched shrubs or rarely small trees with usually medium-sized leaves and with large or small panicles of small, white, usually fragrant flowers followed by small black, or in some varieties



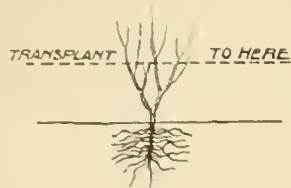
2150. Common method of making privet hedge.
(Scale $\frac{1}{2}$ in. to 1 ft.)

greenish or yellowish white, berry-like fruits, often remaining on the branches through the whole winter. Some deciduous species, as *L. vulgare*, *L. Ito*, *L. acuminatum*, and *L. amurense*, are hardy North, while others, like *L. ovalifolium*, *L. sinense* and *L. Quihoui*, can not be considered quite hardy north of Long Island. The evergreen species are only half-hardy or tender, but *L. japonicum* may be grown as far north as Philadelphia. They are all very valuable for shrubberies, with their clean, dark green foliage, which is rarely attacked by insects and keeps its green color mostly unchanged until late in fall, though *L. acuminatum* sheds the leaves rather early and *L. Ito* and sometimes *L. ovalifolium* assume a pretty purplish hue; in mild winters some of the deciduous species hold part of their foliage until almost spring. *L. vulgare*, *L. ovalifolium* and others stand dust and smoke well and are valuable for planting in cities. *L. ovalifolium* is one of the best shrubs for seaside planting, growing well in the very spray of the salt-water (known as California privet). Some are handsome in bloom, especially *L. sinense*, *L. Mossalongianum*, *L. Ito*, *L. japonicum*, *L. lucidum* and most of the other evergreen species; all are conspicuous in autumn and winter from the black berries, or in some varieties of *L. vulgare*, whitish, greenish or yellowish. *L. vulgare*, *L. ovalifolium* and *L. amurense* are well adapted for ornamental hedges; also *L. sinense* is used as a hedge plant, particularly in the South. The privets grow in almost any kind of soil, and even in rather dry situations and under the shade and drip of trees. Propagate by seeds sown in fall or stratified, sometimes not germinating until the second year; usually increased by cuttings of hardwood or by greenwood cuttings in summer under glass; varieties are sometimes grafted on *L. vulgare* or *L. ovalifolium*.

California privet for hedges. (Henry Hicks.)

First method.—Cuttings 8 to 14 inches of one-year wood are made in fall or winter, preferably the former, as they are occasionally damaged by the winter, even as far south as Alabama. These are tied in bundles and buried during winter. In the spring they are stuck in rows 2 to 6 inches by 2 to 3½ feet, and kept cultivated. They are sold at one year, when 1 to 2½ feet high, or at two years, when 2 to 4 feet high. If not sold at two years the plants are sometimes cut back to 3 inches to sprout again. They are dug by spade or tree-digger. These closely grown plants will make a

hedge, as shown in Fig. 2150, especially if dug with spade and given short roots. If three-year plants, not cut back, are used, the base is open, as the old wood at the lower part of the plant has had its side branches weakened or killed by crowding and they do not readily branch out. Plants grown by this method are frequently planted in a double row.

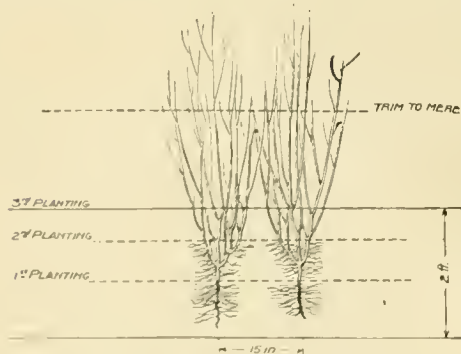


2151. California privet from short cuttings, transplanted deep. (Scale $\frac{1}{2}$ in. to 1 ft.).

Cuttings of 5 to 6 inches of stout one-year wood, are made in November. The cuttings are made short so that the roots will not be cut off by the tree-digger. The leaves are stripped off, and the cuttings tied in small bundles, as large bundles mold. These are buried, tops up, over winter. In the spring, before growth starts, they are planted in rich mellow land 4 inches apart, with rows 8 inches apart. To plant, a back furrow is plowed in the center of the block, the top raked off, a line stretched and pegged down. The cuttings can then be inserted nearly full length. The tramping of the row settles the soil enough to expose the top buds. With a one-horse plow the bottom of the furrow is loosened where the planters have packed the soil, and new furrows are made around the strip planted. The cuttings are tilled during summer with a wheel-hoe or hand-plow. To make wide plants, the tips of the shoots are pinched when they are about 3 inches long. This is repeated at intervals of about three weeks during the summer. Nitrate of soda may be used to hasten growth. This method produces a plant as shown in Fig. 2151.

The plants may be dug in the fall and heeled-in to prevent possible winter-killing. They are then sorted into grades and planted in the spring $1\frac{1}{2}$ to 2 feet apart in rows 3 to 4 feet apart against the landside of a deep furrow, and a little soil kicked over the roots. The filling is completed with a one-horse plow. Before filling, fine manure may be spread near the plants.

The plants should be straightened up and trampled firm. When finished, they should have the lower branches covered and the lower end of the cutting not below the level of the tree-digger. The pinching-back process may be continued, or the tips may be cut with a sickle during the early part of the season, especially



2152. The privet hedge at final transplanting.

on plants of the smaller grade. To get more roots on the branches the plants may be hilled-up. They are cultivated with a one-horse cultivator or a two-horse riding cultivator. At two years these will make plants $2\frac{1}{2}$ to $3\frac{1}{2}$ feet high and $1\frac{1}{2}$ to 2 feet wide at the base.

Dig with a tree-digger that operates on one or both sides. The plants may be set 12 to 15 inches apart,

4 to 6 inches deeper than before, and produce a hedge as shown in Fig. 2152. A smaller number of plants is required than when plants grown by the first method are used. As there are numerous vigorous buds near the ground, the growth is very dense at the base. After planting, the tops may be cut off to an even eight.

Various forms of hedge are used, as shown in Fig. 2153. No. *a* is used on Long Island; *b* is used at Newport. At Newport, by repeated clipping, the leaves become very small and the growth dense, resembling a wall. Nos. *d* and *c* frequently result from using narrow plants and allowing them to grow at the top.

Third method.—At Biltmore Nursery, North Carolina, the privet cuttings are run through a stalk-cutter and the pieces sown in a furrow.

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2153. Conventional forms of California privet hedges.

A. Corolla with the tube 2 or 3 times longer than the limb.

B. Lvs. linear-lanceolate or linear, evergreen.

1. *Massalongianum*, Vis. (*L. longifolium*, *L. angustifolium*, *L. myrtifolium*, *L. rosmarinifolium*, and *L. spicatum*, Hort.). Erect shrub, to 3 ft., with warty and pilose branchlets: lvs. tapering at both ends, glabrous, $1\frac{1}{2}$ –3 in. long; panicles much branched, many-fl., with rather small pedicelled fls., $2\frac{1}{2}$ – $3\frac{1}{2}$ in. long. July, Aug. Himalayas. G.C. II. 16:149.—Graceful half-hardy shrub, one of the most floriferous.

BB. Lvs. oblong to ovate or oval.

C. Young branchlets and infl. pubescent: lvs. deciduous.

D. Calyx glabrous or pubescent only at the base: habit upright or upright-spreading.

2. *acuminatum*, Koehne (*L. ciliatum*, Rehd., not Blume. *L. medium*, Hort., not Franch. & Sav.). Shrub, to 6 ft., with erect and spreading branches: lvs. rhombic-ovate or ovate-lanceolate, acute at both ends, appressed pubescent near the margin and finely ciliate and pubescent on the midrib beneath, 1–3 in. long; panicles small, erect, 1–2 in. long; fls. almost sessile; calyx glabrous: fr. shining black, ovoid, $\frac{1}{2}$ in. long. June. Japan. S.T.S. 1:71. M.D. 1904, p. 73.—This species has been intro. under the erroneous denomination of *L. medium*, which is sometimes misspelled *L. meadia*. It is the first to lose its lvs. in autumn. Var. *macrocarpum*, Schneid. (*L. macrocarpum*, Koehne). More upright: lvs. larger: fr. larger, $\frac{1}{2}$ in. long. M.D. 1904, p. 75.

3. *amurense*, Carr. (*L. Ibota* var. *amurense*, Hort.). Shrub, to 15 ft., with upright branches: lvs. oval or oblong, usually obtuse, somewhat glossy above, glabrous except the midrib beneath, $1\frac{1}{2}$ in. long; pani-

cles erect, often rather many-flid., 1-2½ in. long; fls. short-pedicelled; calyx glabrous or slightly pubescent near the base; fr. slightly bloomy, ovoid, ½ in. long. June, July. Japan, China. R.H. 1861, p. 352. S.T.S. 1:72. M.D. 1904, p. 72.—Similar in habit to *L. ovalifolium* and almost half-evergreen.

DD. Calyx pubescent: habit wide-spreading.

4. *Ibota*, Sieb. (*L. obtusifolium*, Sieb. & Zucc.). Fig. 2154. Shrub, to 10 ft., with spreading and curving branches: lvs. elliptic to oblong-obovate, acute or obtuse, usually only pubescent on the midrib beneath, 1-2 in. long; panicles nodding, small, 1-1½ in. long, numerous along the branches on short branchlets; fls. short-pedicelled; calyx pubescent: fr. with slight bloom, subglobose, ½ in. long. June, July. Japan, China. G.F. 6:425. M.D.G. 1899:218. M.D. 1904, p. 71. S.I.F. 1:83. C.L.A. 3:180 (as var. *Regelianum*).—Graceful shrub, hardy N. Var. *Regelianum*, Rehd. (*L. Regelianum*, Koehne). Low, dense shrub with almost horizontally spreading branches and oblong or obovate, usually more pubescent lvs. M.D. 1904, p. 70. R.H. 1904, pp. 434, 435. F.E. 20:811 (as *L. amurense*).

CC. Young parts glabrous: lvs. half-evergreen.

5. *ovalifolium*, Hassk. (*L. californicum*, Hort. *L. japonicum*, Hort., not Thunb. *L. medium*, Franch. & Sav.). CALIFORNIA PRIVET. Shrub of upright habit, to 15 ft., quite glabrous: lvs. cuneate at the base, elliptic-ovate or elliptic-oblong, acute, dark green and glossy above, yellowish green beneath, 1½-2½ in. long; panicles erect, many-flid., rather compact, to 3 in. long; fls. almost sessile. July. Japan. F.E. 33:1223. S.I.F. 1:84.—A very handsome shrub, but of somewhat stiff habit; well adapted and much used for hedges (see Mn. 6, p. 9). Var. *aureo-marginatum*, Hort. Lvs. edged yellow. Var. *variegatum*, Hort. (var. *robustum variegatum*, Hort.). Lvs. variegated with yellow. Var. *tricolor*, Hort. Lvs. variegated with yellowish and white, pinkish when young (Mn. 2, p. 42). Var. *multiflorum*, Hort. Very free-flowering. G.C. III. 50:237.

AA. Corolla with the tube as long as the limb or shorter.

B. Young growths glabrous: lvs. evergreen.

6. *japonicum*, Thunb. (*L. glabrum*, Hort. *L. Kellermanii*, Vis. *L. Kellermannii*, *L. Sieboldii*, *L. spicatum*, and *L. syringiflorum*, Hort.). Bushy shrub, to 10 ft.: lvs. roundish ovate to ovate-oblong, acute or obtusish, with reddish margin and midrib, veins beneath not distinctly marked. 2-3½ in. long; panicles broad, rather loose, to 4½ in. long; corolla-tube usually somewhat longer than calyx. July, Aug. Japan. R.B. 25:84. S.I.F. 1:82. G.W. 2, p. 567.—Very handsome evergreen shrub, but in colder climates often losing the lvs. in fall; often confounded with the following, and also with the preceding.

7. *lucidum*, Ait. (*L. japonicum macrophyllum*, *L. magnoliaefolium*, *L. sinense latifolium robustum* and *L. spicatum*, Hort.). Large shrub or tree, to 20 ft., with somewhat spreading branches, similar to the former: lvs. larger, ovate to ovate-lanceolate, acute or acuminate, distinctly veined beneath, 3-5 in. long; panicles less loose, with almost sessile fls.; tube about as long as calyx. July, Aug. Japan, China. B.M. 2565:2921 (as *L. nepalense glabrum*). G.C. II. 10:753.—Larger lvd. than the former, but more tender. It yields the white wax, an exudation of the branches, caused by an insect, *Coccus Pe-lah*; therefore cult. in China. Var. *Alivonii*, Arb. Kew. (*L. japonicum* var. *Alivonii*, André). Lvs. ovate-lanceolate, to 8 in. long, acuminate, sometimes with yellowish variegation when young. Var. *aureo-marginatum*, Hort. (*L. excelsum aureum*,

Hort.). Lvs. margined yellow. Var. *tricolor*, Arb. Kew. (*L. japonicum tricolor*, Hort.). Lvs. with yellowish variegation, pink when young.

8. *coriaceum*, Carr. (*L. lucidum* var. *coriaceum*, Deene. *L. japonicum* var. *coriaceum*, Makino). Dwarf, dense shrub, with short, rigid branches, to 6 ft., very leafy: lvs. orbicular or orbicular-ovate, convex, dark green and shining above, 1½-2½ in. long; panicle compact, 2-4 in. long, with sessile fls. July. Cult. in Japan, not known wild. B.M. 7519. R.H. 1874, p. 418; 1888, p. 440. F. 1876, p. 65. G.C. III. 53:265.

BB. Young branchlets and infl. pubescent or puberulous.

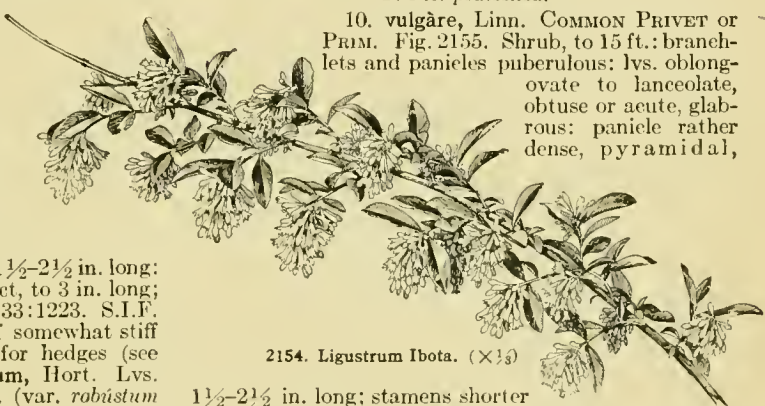
C. Lvs. evergreen, 2-5 in. long.

9. *nepalense*, Wall. (*L. spicatum*, Don). Evergreen shrub or tree, with pubescent branchlets: lvs. oblong or oblong-ovate, acuminate, pubescent beneath, 2-5 in. long; panicles rather large and broad, interspersed with petioled bracts. July, Aug. Himalayas.

CC. Lvs. deciduous or half-evergreen, 1-2½ in. long.

D. Fls. pedicelled.

10. *vulgare*, Linn. COMMON PRIVET or PRIM. Fig. 2155. Shrub, to 15 ft.: branchlets and panicles puberulous: lvs. oblong-ovate to lanceolate, obtuse or acute, glabrous: panicle rather dense, pyramidal,



2154. *Ligustrum Ibota*. (× 1/3)

1½-2½ in. long; stamens shorter than the limb. June, July. Eu., N. Afr., W. Asia. Naturalized in some places, chiefly in the E. B.B. (ed. 2) 2:729. F.E. 33:1273. H.W. 3:122.—Many garden forms. Var. *buxifolium*, Nichols. Lvs. ovate or oblong-ovate, obtuse, half-evergreen. Var. *glaucum*, Hoeffker (var. *glaucum albo-marginatum*, Spaeth). Lvs. bluish green, with narrow white margin. G.W. 2; p. 495. Var. *sempervirens*, Loud. (*L. vulgare* var. *italicum*, Kirchn. *L. italicum*, Mill. *L. sempervirens*, Pieri). Lvs. linear-lanceolate, almost evergreen. Var. *pendulum*, Hort., with pendulous branches. Var. *pyramidalis*, Spaeth, with strictly upright branches. There are also varieties with frs. of different colors, as var. *chlorocarpum*, Loud., with greenish, var. *leucocarpum*, Loud., with whitish, and var. *xanthocarpum*, Loud., with yellowish frs. Variegated forms are: var. *aureum*, Hort., with yellow foliage, and var. *variegatum*, Hort., with the lvs. blotched yellow. Var. *lutescens*, Hort., has deep cream-yellow fls.

11. *sinense*, Lour. (*L. Fortunei*, Hort. *L. villosum*, May). Shrub, to 8 ft., with slender spreading branches: branchlets pubescent: lvs. elliptic to ovate-lanceolate, usually acute, pubescent along the midrib beneath, at least when young, 1-3 in. long; panicles pubescent, loose, to 4 in. long, with distinctly pedicelled fls.; stamens longer than the limb. China, Korea. G.C. 1858:621. Var. *Stauntonii*, Rehd. (*L. Stauntoni*, DC.). Less high and more spreading; lvs. oval to ovate, usually obtusish, pubescent on midrib beneath; panicle broader and more loose. G.C. II. 10:365. G.F. 3:213. Var. *nitidum*, Rehd. Branchlets puberulous or minutely pilose; lvs. ovate-oblong to ovate-lanceolate, acute or acuminate, lustrous above. Cent. and W. China.—In some southern nurseries *L. sinense* has been offered under the name of *L. amurense*.

DD. Fls. sessile.

12. *Quihoui*, Carr. (*L. brachystichyum*, Deene.). Shrub, to 6 ft., with spreading branches; branchlets and panicles finely pubescent; lvs. elliptic-oblong or narrow-oblong, obtuse, glabrous, somewhat coriaceous, 1-2 in. long; fls. sessile, in small clusters, forming at ends of the branches long, panicle spikes, Sept.-Oct. China. G.C. H. 18, p. 277. Gn. 66, p. 292.



2155. *Ligustrum vulgare*. ($\times \frac{1}{2}$)

L. acutissimum, Koehne. Allied to *L. Ithota*. Lvs. lanceolate, acuminate, $\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; panicle about 1 in. long; calyx glabrous; anthers shorter than limb. Cent. China.—*L. ciliatum*, Sieb. Allied to *L. acuminatum*. Lvs. rhombic-ovate, acute, ciliate; panicle dense, small, about $\frac{1}{2}$ in. long, 4-8 fld. Japan.—*L. compactum*, Hook. f. & Thoms. (*L. lanceifolium*, Carr. *L. longifolium* and *L. lineare*, Hort., and *L. Simoni*, Carr.). Evergreen shrub, quite glabrous; lvs. lanceolate, to 6 in.; panicle large, compact; tube short. Himalayas. R.H. 1902, p. 500.—*L. Delavayanum*, Harriot (*L. Prattii*, Koehne). Low evergreen shrub with spreading or nearly prostrate, pubescent branches; lvs. ovate to ovate-oblong, glabrous, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long; panicles narrow, leafy at the base, 1-1 $\frac{1}{2}$ in. long; corolla-tube longer than the limb. W. China. R.H. 1901, p. 496 (habit).—*L. Henryi*, Hemsl. Evergreen shrub, to 12 ft.; branchlets pubescent; lvs. orbicular-ovate to ovate-lanceolate, obtusely acuminate, dark green, glabrous, $\frac{1}{2}$ -2 in. long; panicles terminal, short-stalked, 1 $\frac{1}{2}$ -4 in. long; corolla-tube longer than limb; calyx glabrous. W. China.—*L. insulare*, Deene. (*L. Stauntonii*, Hort., not DC.). Shrub, to 6 ft., allied to *L. vulgare*; lvs. elliptic-ovate to linear-lanceolate, yellowish green, often pendulous, 2-3 in.; panicles rather large. Origin uncertain.—*L. lanceifolium*, Carr., *L. longifolium*, and *L. lineare*, Hort.—*L. compactum*, *L. pakuense*, Hort.—*Syringa pakuensis*.—*L. Prattii*, Koehne.—*L. Delavayanum*.—*L. Simoni*, Carr.—*L. compactum*.—*L. Stauntonii*, Hort.—*L. insulare*.—*L. stronglyphyllum*, Hemsl. Evergreen shrub or small tree, almost glabrous; lvs. orbicular or obovate, $\frac{1}{2}$ -1 in.; panicle rather loose. Cent. China. B.M. 8069.—*L. Walckeri*, Deene. Allied to *L. nepalense*; lvs. ovate to lanceolate, glabrous, to 3 in.; panicle large, to 6 in. Ceylon, Neilgherries. G.C. III. 24:282. G.M. 41:683.—*L. yunnanense*, L. Henry. Shrub, to 12 ft.; branches glabrous; lvs. subcoriaceous, oblong-lanceolate, glabrous, 2-5 in. long; panicle loose, 5-7 in. long; corolla-tube short. Yunnan. R.H. 1902, pp. 498-500.

ALFRED RENDER.

LILAC: *Syringa*.

LILIUM (Latin, from the Greek name, said to be derived from the Celtic word *li*, meaning whiteness, referring to *L. candidum*). *Liliaceæ*. LILY. Noble plants for outdoor bloom, and a few of them grown under glass. They comprise one of the distinctive flower forms, and the name lily is applied to many other plants.

Herbaceous perennials with scaly bulbs; sts. unbranched, smooth or pubescent, usually bright green, sometimes tinged purple or brown and generally clothed with lvs. their entire length; lvs. (except in only 2 species, *L. cordifolium* and *L. giganteum*) always linear or lanceolate, either scattered or verticillate, usually bright green and quite sessile, but in a few species with short petioles; fls. terminal, solitary, racemose or umbellate, perfect, with 6 perianth-segms., 3 like sepals or calyx-lvs. and 3 like petals or corolla-lvs., the parts erect or variously spreading or reflexed (Figs. 2156, 2157), usually with a honey-bearing gland at the base of each; each fl. has 6 prominent stamens and 1 long pistil; each stamen consists of a filament or stalk and an anther balanced on its end and attached by its back, while the ovary bears a style and a 3-lobed stigma; the fr. or seed-vessel is an oblong caps. borne above the base of the perianth-segms.; it is 6-ribbed, divided into 3 cells, each cell closely packed with flattened, brown, soft-coated seeds. The genus is divided into 7 groups or subgenera, distinguished from each other chiefly by the shape and arrangement of the fls. These groups are:

- I. Eulirion (true lilies, trumpet- or funnel-flowered lilies).
- II. Archelirion (open-flowered lilies).
- III. Martagon (Turk's-cap or turban-shaped lilies).
- IV. Pseudo-Martagon (bell-flowered lilies).
- V. Isolirion (erect- or upright-flowered lilies).
- VI. Cardiocrinum (heart-shaped-leaved lilies).
- VII. Notholirion (fritillaria-like lilies).

From 300-400 species have been described, but there are probably considerably less than 100 entitled to rank as such. They are all natives of the northern hemisphere, extending around the world. Their northern limit is southern Canada and Siberia; their southern, Florida and the Neilgherry Mts. of India. Many of them are in California and China-Japan.

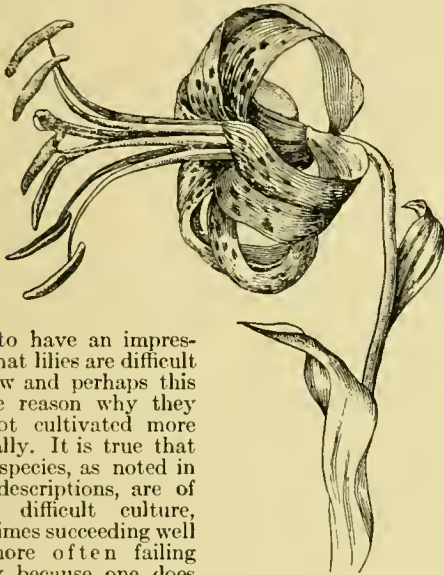
The genus *Lilium* is very closely allied to *Fritillaria*; the latter genus differs in the corolla being more uniformly campanulate, with nectar-bearing cavities at the base of the inner segms. or of all of them, and the anthers attached by the base. *Lilium roseum* is by some referred to *Fritillaria*, but it is probably better kept in *Lilium*. *L. oxypetalum* is a similar case.

For further botanical information, the reader is referred to "The Botanical Gazette," 27:235 (1899), where a botanical review of the genus will be found. The most notable monograph on lilies is entitled "A Monograph of the Genus *Lilium*," by H. J. Elwes, published in 1880 and containing superb colored plates. It is referred to below by the abbreviation El. It covers the ground fully up to the date of publication. Unfortunately there is no book yet published which combines the botanical and horticultural points of view, but much valuable cultural information may be obtained by reading the following four books: Wallace's "Notes on Lilies," 2nd edition; "Lilies for English Gardens," by Miss Jekyll; "The Book of the Lily," by Wm. Goldring, and "Lilies," by Adams and one by A. Grove. Many portraits have been made of species of *Lilium*, some of the most important and accessible of which are cited in the following account. The author cannot vouch for the authenticity of these portraits, however.

The general cultivation of lilies.

The various lilies are unequalled by any other plant in their unique combination of beauty, gracefulness

and stately magnificence; yet they are entirely unknown in many gardens, while in others only a few of the commoner species, like *L. candidum*, *L. speciosum* or *L. tigrinum* are seen. Their culture has been entirely too much neglected in this country, but we are confident that, as their merits become better known, they will be much more largely grown. Many persons



2156. A lily form.—One of the turban or Turk's-cap group, *Lilium superbum*.

seem to have an impression that lilies are difficult to grow and perhaps this is one reason why they are not cultivated more generally. It is true that a few species, as noted in their descriptions, are of rather difficult culture, sometimes succeeding well but more often failing simply because one does not fully understand their needs. It must be remembered that, in their native habitats, the different lilies are found under widely varying conditions of soil, climate and environment, and some kinds are so delicate and capricious that they will not succeed well under cultivation unless the peculiar conditions under which they are found in a wild state can be closely imitated. But, on the contrary, most lilies are robust, long-lived and of easy culture under a variety of soil and climatic conditions. The beginner in lily-culture should always select these easily grown kinds, choosing them according to his own individual taste. There are enough of these to satisfy any ordinary cultivator, unless he becomes an enthusiast or specialist, desirous of securing as large a collection as possible of different species and varieties. In that case, and if space, time and means will permit, he may attempt the culture of the more capricious sorts. The following is a selection of twelve of the best easily grown lilies for general cultivation: *L. candidum*, *L. regale*, *L. auratum* var. *platyphyllum*, *L. speciosum* var. *magnificum*, *L. tigrinum* var. *splendens*, *L. monadelphum*, *L. superbum*, *L. testaceum*, *L. Martagon* var. *glabrum*, *L. tenuifolium*, *L. croceum*, *L. dauricum* var. *incomparabile*.

By using care and judgment, suitable lilies may be chosen for almost any location or purpose. Nearly all species are desirable for planting in combination with other hardy perennial plants or scattered among dwarf-growing shrubs in such a manner that the flowers will rise above their foliage, thus imitating nature, for in a wild state the lower part of the stem of many species is thickly surrounded with grass or dwarf undergrowth, while the upper part and flowers rise free. Many lilies also produce a charming effect when planted in front of large shrubs, such as magnolias and rhododendrons, the flowers showing up well against the background of green. For large beds or massing, only such kinds as produce a showy display of flowers should be chosen. *L. candidum*, *L. dauricum*, *L. elegans*, *L. speciosum*,

L. tigrinum and their varieties are especially desirable for this purpose. Sometimes different species or varieties are planted together in the same bed, but, unless space is limited, it is usually better to keep them separate. Any of the strong-growing permanent lilies, *L. superbum*, *L. tigrinum*, and many others, are excellent for naturalizing in wild or uncultivated ground. Some of the smaller-growing kinds, like *L. concolor*, *L. elegans*, *L. tenuifolium*, are desirable for planting in rock-gardens with other plants. In the northern states the capricious sorts, like *L. japonicum* and *L. Leichtlinii*, often succeed better when grown in coldframes or pots than in the open ground, and if their culture is attempted this method is recommended.

The flowers of all lilies, with the exception of a few ill-smelling species, are excellent for cutting. Only the upper part of the stem should be cut off, however, leaving the foliage on the lower part, so the bulb may complete its growth. If the stem is cut off right down to the ground when in active growth, the bulb will be injured or perhaps destroyed.

Soils and location.

Most lilies will succeed in any light, sandy or loamy soil. Decayed peat or leaf-mold may be added with advantage, as the American species are especially partial to a peaty soil. Some species, like *L. candidum*, *L. croceum*, *L. elegans*, *L. Hansonii*, *L. monadelphum*, *L. tigrinum* and most of the European Turk's-cap lilies will also do well in a heavier soil, even clay if it is well drained. Good drainage is an essential point, for no lilies, with the possible exception of *L. canadense* and *L. superbum*, will live in a wet or swampy soil, where stagnant water stands around the bulbs. Whenever possible, a slightly sloping location with a porous gravelly subsoil should be chosen. Several species, like *L. candidum*, *L. chalcedonicum*, *L. carniolicum*, *L. Hansonii*, *L. monadelphum*, *L. Martagon*, *L. pomponium*, *L. testaceum* and a few others will thrive in a calcareous or limestone soil, but lime is poison to most lilies and with these exceptions they should never be planted in soils containing it. Of whatever nature the soil, it should be fairly rich and if not naturally so a liberal quantity of thoroughly decayed cow- or sheep-manure should be mixed in before planting the bulbs. In after years, additional nourishment may be provided by top-dressings of decayed manure. Fresh manure of any kind should never be used, as it attracts worms and causes the bulbs to decay.

Although, as noted above, good drainage is necessary, yet lilies like plenty of moisture when in active growth. Frequent shallow cultivation or mulching will help to conserve the moisture already in the soil, but in periods of drought artificial watering may be necessary.

Some lilies, as *L. candidum*, *L. croceum*, *L. elegans*, *L. Martagon*, *L. monadelphum* and *L. tigrinum*, will often succeed very well in full sunshine and exposure. Others, however, like *L. auratum*, *L. Hansonii*, *L. Henryi*, *L. japonicum*, *L. Parryi*, *L. washingtonianum*, often fail or the flowers bleach or fade quickly in such situations. As a rule, however, it may be said that all lilies will thrive better in partial shade, and the flowers will last longer. The ideal location is under trees or large shrubs, but far enough away so that their roots will not rob the lilies of moisture and



2157. A lily form.—One of the Archelirion kinds. Form of *L. speciosum*.

nourishment. In such places, they will receive a free circulation of light and air, but the full force of the hot midday sun cannot reach them.

Protection from cold and wind.

In cold climates, the bulbs of all lilies should be protected from freezing during winter by a heavy covering of leaves, hay or straw. Some species, as *L. bulbiferum*, *L. candidum*, *L. elegans*, *L. tigrinum*, are apparently not greatly injured if the bulbs freeze, but frost is fatal to many, especially the Californian and Indian species, and even the hardiest kinds will do better if the bulbs are protected from it. Frost sometimes also injures the tender young growth of *L. auratum*, *L. chalcedonicum*, *L. Hansonii*, *L. longiflorum*, *L. speciosum*, *L. testaceum* and others which appear above ground very early in spring. This can be prevented by covering the plants with old sheets, or something similar, on cold nights when frost is expected.

To prevent the stems of lilies from being broken by high winds, each plant or clump should be supported with a stick or stake, preferably of bamboo, tying them together with soft yarn or twine. It is better, however, wherever possible, to plant lilies in such a way that they will not require staking, as this deprives them of their natural gracefulness of swaying with the breeze.

The planting.

The best time to plant lily bulbs is soon after the flowers fade or seeds ripen. They cannot always be obtained at that time, however, imported ones often not being received until late in autumn or winter. In the northern states, the places intended for these late-received bulbs should be prepared previously and covered with 5 or 6 inches of leaves or litter, to prevent the ground from freezing. This should be removed and the bulbs planted as soon as received, afterward replacing it as a winter mulch. Or, if preferred, the bulbs may be packed in boxes of sand, leaf-mold or sphagnum moss and stored in a cool dark frost-proof cellar, closet, or shed until spring, when they should be planted. The material they are packed in must be kept constantly moist, neither too wet nor too dry. In this connection it might be well to add a few words of advice in regard to the purchase of lily bulbs. Whenever possible, freshly dug home-grown bulbs should be secured or at least those which have been shipped only short distances, which have not been deprived of their roots, and whose scales have not become dried or shriveled. Such bulbs, although they may cost more than imported ones, which have often been kept out of the ground for several months, are well worth the difference.

No definite rules can be given in regard to the proper depth and distance apart to plant the bulbs, but usually they should be set so that their top or apex will be three times as deep as their greatest diameter. The smaller-growing species, as *L. concolor*, *L. elegans*, and *L. tenuifolium*, may be planted about 6 inches apart, while from 12 to 18 inches is not too much space for the largest species, like *L. auratum*, *L. tigrinum*, and so on. When planting the bulbs, it is a good plan to surround each one with sand or fine gravel, which helps to drain away surplus moisture and also tends to repel worms. Some growers also place a handful of fresh sphagnum moss under each bulb, thinking it induces a better root-growth.

It is the nature of many lilies to throw out annual fibrous roots from the underground stem above the bulb (called stem-roots), in addition to the large permanent ones at its base (called basal or bulb-roots). The following species and their varieties belong to this class: *L. auratum*, *L. Batemanii*, *L. Brownii*, *L. bulbiferum*, *L. concolor*, *L. croceum*, *L. dauricum*, *L. elegans*, *L. Hansonii*, *L. Henryi*, *L. japonicum*, *L. Leichtlinii*, *L. longiflorum*, *L. Murinowiczii*, *L. medeoloides*, *L. odo-*

rum, *L. regale*, *L. rubellum*, *L. Sargentiae*, *L. speciosum*, *L. sulphureum*, *L. sutchuenense*, *L. tigrinum* and *L. Wallacei*.

The following species and their varieties produce but few, if any, stem-roots: *L. Bolanderi*, *L. callosum*, *L. canadense*, *L. candidum*, *L. carniolicum*, *L. carolinianum*, *L. chalcedonicum*, *L. columbianum*, *L. giganteum*, *L. Grayi*, *L. Humboldtii*, *L. Kelloggii*, *L. maritimum*, *L. Martagon*, *L. monadelphum*, *L. pardalinum*, *L. Parryi*, *L. parviflorum*, *L. parvum*, *L. philadelphicum*, *L. pompanium*, *L. pyrenaicum*, *L. Roczii*, *L. superbum*, *L. tenuifolium*, *L. testaceum* and *L. washingtonianum*.

The bulbs of these non-stem-rooting species, when not received or planted until late autumn or spring, often remain dormant until the second summer, because the basal roots, on which the flower-stem must depend entirely for its support, have been cut off or dried up by exposure to the air, and consequently the bulbs are so weakened that it takes them a year or more to recover and form new roots. Sometimes, however, a small weak stem develops the first summer, which soon perishes without flowering. On the contrary, the stem-rooting species usually bloom well the first summer after planting, because, even if the bulbs do not produce roots they are formed at the base of the stem, which is nourished and supported by them.

Propagation.

Lilies are propagated by division of the offsets, by bulbils, by scales or by seeds. The best and easiest method with most species is by division of the offsets, which form at the base of the parent bulb, on the underground stem above the bulb, or on the end of a rhizome. The best time to do this dividing and replanting is from two to four weeks after the flowers fade or immediately after seeds ripen, as that is the only time the bulbs are really dormant and many species greatly dislike to be disturbed when the roots are in active growth. The clumps should be carefully dug up and the large flowering bulbs planted immediately where they are to remain permanently, while the smaller ones may be planted in beds by themselves, removing them to their permanent location when they become large enough to bloom, which will usually be in two or three years.

Sometimes, when separating and replanting the bulbs, fresh healthy scales become detached. If these are planted in rows 2 inches apart and 1 or 2 inches deep, in light sandy soil, either in boxes, coldframes or the open ground, one or more tiny bulbs will usually form at the base of each scale, where it was broken off. These will become large enough to bloom in two or three years.

L. bulbiferum, *L. Sargentiae*, *L. sulphureum* and *L. tigrinum* and its varieties usually produce small dark green or purple bulbils or bulblets in the upper leaf-axils. If these are removed before they drop to the ground and planted, like the detached scales, they will bloom in two or three years.

Raising lilies from seeds is very interesting, but it requires time, care and patience. Under favorable conditions, most lilies will produce seeds, but a few species often remain sterile, unless the flowers are hand-fertilized. Among these may be mentioned *L. Brownii*, *L. candidum*, *L. Hansonii*, *L. longiflorum*, *L. speciosum*, *L. sulphureum*, *L. testaceum*, *L. tigrinum*, *L. Wallichianum* and some varieties of *L. elegans*. Freshly-gathered seeds, sown soon after they ripen, will germinate more quickly than those which have been kept until they become hard and dry, but in all cases the period of time required for germination varies greatly with the species. For example, fresh seeds of *L. tenuifolium* will often germinate in a month, or even less, while those of *L. auratum* and many others will seldom germinate until the following spring and often not until a year later. Similarly, the time required for

the seedlings to become large enough to bloom varies greatly. *L. philadelphicum*, *L. tenuifolium* and a few others will often bloom the second summer after the seeds germinate, while *L. giganteum* seldom blooms before five or six years have passed. Most species, however, require three or four years. The seeds should be sown thinly in boxes of light sandy soil, in rows about 2 inches apart and covered about $\frac{1}{2}$ inch deep with finely sifted sphagnum moss. The boxes should be kept in the house or greenhouse until the seedlings appear, when they may be set outdoors, in a shady place, during the summer. When the young plants are 2 or 3 inches high, they should be transplanted into coldframes or prepared beds in the open ground, later removing them to their permanent location.

Insects and diseases.

Lilies are seldom troubled by insect foes of any kind. Worms will sometimes eat the bulbs, but if they are surrounded with sand, as previously suggested, and fresh manure is never used, they will not be likely to be attacked. Mice will also eat the bulbs and the only way to get rid of them is by poisoning or trapping. Aphid or green-flies occasionally attack the plants, especially when under glass, but they may be readily destroyed by spraying the plants with kerosene emulsion.

There are several fungous diseases that are very destructive to lilies. Probably the worst and most common one is a species of *Botrytis*. It attacks all kinds of lilies, without any exception, either wild or cultivated, and may appear at any stage of their growth. It is first noticed as buff or rust-colored spots or blotches on the leaves or buds, which soon become covered with a grayish mold. When the disease first appears, all affected parts should be cut off and burned, while the attacked plants, as well as healthy ones growing near them, should be sprayed with some good fungicide, like bordeaux mixture. Then, if the disease persists in spreading, the only thing to do is to dig up the plants, bulbs, roots and all, and burn them.

Another fungous disease, known as *Rhizopus necans*, is very destructive to imported Japanese bulbs, especially those of *L. auratum*. It attacks the base of the scales, causing them to decay, and the bulbs, if left exposed to the air for a few days, become soft and rotten and covered with a long white silky fungous growth. As soon as the bulbs are received, they should be carefully examined and those that show the least signs of the disease burned at once, as they seldom recover. Those which appear perfectly sound are often covered with the spores of the fungus and to destroy them the bulbs should be soaked for several hours in a solution of one part carbolic acid to forty parts water. Another method, practised by some growers to prevent the disease from being introduced into their gardens, is to plant the apparently sound bulbs singly in pots or tin cans, and later, those which are healthy and well-rooted should be transplanted to the open ground, while diseased ones should be burned and the soil in the pots sterilized.

The American florists' lily trade. (David Lumsden.)

The lily has become one of the popular plants of the American trade. Its popularity is due not alone to the fact that *Lilium longiflorum* is the acknowledged Easter lily of commerce, but it is a plant particularly well adapted for church, wedding and other decorations at any season of the year. Lilies are also exceptionally useful as cut-flowers for design work and for Memorial Day trade.

Many million bulbs of *L. longiflorum* and its varieties are imported from Japan, Formosa and Bermuda each year. It is an exceedingly important commercial crop, and several of the larger eastern and western

growers force as many as 200,000 bulbs in a single season.

Lilium longiflorum var. *eximium*, which is grown under the trade name of *L. Harrisii*, was for years the principal variety grown for early blooms and for Easter sale. Unfortunately, the variety is attacked by a bacterial disease, and healthy stock is almost impossible to obtain. The lily disease is prevalent in all sections and countries from which the bulbs are imported, and growers find, under forcing conditions, that from 3 per cent to 33 $\frac{1}{2}$ per cent of the bulbs are affected. *L. longiflorum* var. *eximium* is especially susceptible to the disease, but all varieties are now attacked to a greater or less degree. Within the last few years, however, more careful propagation and better cultural conditions have eliminated the disease to a considerable extent, and as a result, there has been an improvement in the crop.

During the earlier period of forcing Easter lilies, they were placed on the market only in the late winter or early spring months. Within recent years, improved methods of cold storage have made possible the production of blooms of the so-called Easter lilies at any season of the year. However, the larger number of blooms are placed on the market in Easter week, for in the minds of the flower-loving public no other flower is so suggestive of the Easter spirit.

The species of lilies forced under glass may be divided into three groups:

GROUP I. *Lilium longiflorum*, Easter lily.

- (a) *Lilium longiflorum*.
- (b) *Lilium longiflorum*, Formosa type.
- (c) *Lilium longiflorum* var. *eximium* (*L. Harrisii*).
- (d) *Lilium longiflorum* var. *giganteum*.
- (e) *Lilium longiflorum* var. *multiflorum*.

Lilium longiflorum var. *giganteum* is now the most popular for Easter trade; it is also the lily used almost exclusively for cold storage. *L. longiflorum*, Formosa type, *L. longiflorum* var. *multiflorum*, and *L. longiflorum* var. *eximium*, are used more especially for earlier flowering.

GROUP II. *Lilium speciosum* (*L. lancifolium*).

- (a) *Lilium speciosum* var. *album*.
- (b) *Lilium speciosum* var. *rubrum*.
- (c) *Lilium speciosum* var. *roseum*.
- (d) *Lilium speciosum* var. *Melpomene*.

Lilium speciosum ranks next to *L. longiflorum* as the most valuable for forcing. The varieties *album*, *roseum*, and *rubrum* are the most in demand. They are now forced in winter and spring by using bulbs that have been retarded in the cold storage. The natural blooming period of this species is July and August, and the flowers are then useful for floral designs and cut-flowers.

GROUP III. *Lilium candidum* (Madonna lily).

There are two forms of *L. candidum*; one with thin, star-like petals, not much recurved; the other having the broad, stoutly ribbed petals strongly recurved. This latter type is the one most commonly used for forcing. Bulbs of *L. candidum* are now imported from northern France. Recently, the lily disease has been so prevalent in the Marseilles district that the stock from that section has been less used for forcing purposes.

Forcing of lilies under glass.

When the bulbs are received, they should be potted into suitable-sized well-drained flower-pots, using a compost of three parts of good fibrous loam to one part of well-decayed horse- or cow-manure. There is a difference of opinion as to potting methods. Some growers prefer to place the bulbs first in 4-inch flower-pots, and when a strong root-system has developed,

they are shifted into 6- or 7-inch flowering pots. Other growers place the bulbs directly in 6-inch pots, filling them about one-half full of compost, and at a later date when active growth has begun, a rich top-dressing of equal parts loam and cow-manure is added.

When the lilies are first potted, they are placed in a coldframe, watered thoroughly and covered with sphagnum moss, straw, or cinders. Wooden shutters are placed over the frames to keep the bulbs dark and to protect them from rain and heavy freezing. Under such conditions the bulbs will root readily. Before hard frosts, they are removed to a greenhouse and given a temperature of 45° to 50° F. at night for a week or ten days. When top-growth commences, a steady night temperature of 60° F. is maintained, raising the temperature to 70° during the day. Lilies should be given abundant ventilation and the plants should be freely syringed on bright mornings, but the foliage should be dry during the night.

It will require approximately thirteen weeks from the time that the plants are brought into the house to get them into flower, provided a temperature of 60° F. is maintained. It should be remembered, however, that weather conditions are dominant factors in lily-forcing; therefore, allowance must be made for a longer period for forcing if the weather is exceptionally dark or cloudy. Sometimes a slightly increased temperature shortens the period of forcing, and such an increase is not detrimental to the value of the flowers. If the buds are forced into flower at too high temperature, however, the keeping qualities of the flowers may be considerably injured. In order to have lilies in their prime for Easter, the buds should show about six weeks previous to that date. They may then be gradually developed, and if they advance too rapidly, they may be placed in a cooler temperature. No group of lilies will develop evenly, and it often requires excellent judgment so to shift the plants into different temperatures that the blooms will open at the proper date. If lilies are too advanced, retarding should not begin until the buds have lost their green color, for when once retarded, it is difficult to start them into growth again. A temperature of 45° to 50° F. at night, with a light shading on the glass, is recommended for developing the flower-buds.

For best success in forcing lilies, the water used for both watering and syringing should be warmed to about 70° F. Soil moisture extremes, caused by over-watering or by neglect, should be avoided.

When the lilies begin to show the buds, a weekly application of liquid manure may be given, using one bushel of cow-manure to fifty gallons of water. If the growth is very slow, three pounds of sodium nitrate may be added to the liquid manure, or it may be used separately in liquid form, using one ounce to one gallon of water.

If the plants are tall, they should be tied erect to neat stakes. Under forced conditions, the lily seems particularly susceptible to attacks of green aphids; therefore, fumigations and spraying with nicotine should be practised regularly throughout the period of growth. If young plants are kept free from aphids, they will be less likely to gain a foothold on the buds. They are particularly injurious to developing buds, for their attacks result in a malformation of the tissue.

Cold-storage lilies.

These are used for planting only from March 1 to September 1, the regular stock being depended on for the remainder of the year. The culture of cold-storage lilies differs from that pursued in the growing of lilies for Easter, as they may be placed in the forcing-house with a temperature of 60° F. immediately after potting. During the warm months, they will bloom in ten weeks from the time started. Those started earlier will require from ten to thirteen weeks.

Lilium speciosum and its varieties are easily grown. The method of culture does not vary much from that of *L. longiflorum*. They are grown either singly in 6-inch pots or planted in boxes. These boxes are 6 inches deep, and the bulbs are placed about 6 inches apart. The box method of culture is recommended because the roots of the lilies are not so liable to dry out as when pots are used.

Lilium candidum differs from *L. longiflorum* and *L. speciosum* in its temperature requirements. Too high temperature is disastrous to it, and a temperature of 50° or 55° F. suits it best. This species is seldom forced except for Easter and Memorial Day trade.

Notes on lily culture.

Allow thirteen weeks from the time the lilies are brought into the greenhouses, to get them into flower. A temperature of 60° F. at night, and 70° F. during the day, will be required.

It will take six weeks from the time the buds show, to the flowering period.

The best cold-storage temperature for lily bulbs is 34° F.

One of the most satisfactory lilies for Christmas is *Lilium longiflorum* var. *giganteum*. The bulbs should be potted September 15. *L. longiflorum* var. *giganteum* to be in flower for Easter should be potted in November.

By weekly plantings and proper culture, it is possible to have lilies in bloom throughout the year.

Early shipments of lilies arrive in time to follow the last of the cold-storage bulbs.

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LXV. *Lilium speciosum* in an attractive setting.

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- EE. *Bulb oblate*..... 10. *Brownii*
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 CCC. *Fls. pink*.
 D. *Anthers red*..... 12. *iaponicum*
 DD. *Anthers yellow*..... 13. *rubellum*
 BB. *Lvs. mostly verticillate, several nerved*.
 C. *Fls. white, pink or purple*..... 14. *washingtonianum*
 CC. *Fls. yellow*..... 15. *Parryi*

KEY TO THE SUBGENERA.

Perianth trumpet- or funnel-shaped, horizontal or nearly so, with oblanccolate segms., broadest near the end, smooth inside, falcate only at the tip or apex; stamens slightly curved, parallel with the style. I. *EULIRION*. Species 1-15.

Perianth broadly funnel- or bell-shaped, but without any tube, horizontal or becoming pendulous; segms. ovate-lanceolate, broadest near the base, papillose inside and becoming deeply falcate; stamens diverging widely from the curved style; lvs. scattered, 5-7-nerved.

II. *ARCHELIRION*. Species 16-19.

Perianth broadly bell-shaped, pendulous or nearly so; segms. usually lanceolate, broadest near the middle, sometimes slightly ovate-lanceolate, becoming deeply recurved or reflexed, and, unless noted, smooth inside; stamens diverging on all sides from the curved or almost straight style.

III. *MARTAGON*. Species 20-41.

Perianth bell- or thimble-shaped, with oblanccolate segms., smooth inside, slightly or not at all reflexed; stamens diverging from the almost straight style; lvs. verticillate, usually 3-5-nerved.

IV. *PSEUDO-MARTAGON*. Species 42-46.

Perianth erect, broadly funnel-shaped; segms. lanceolate or nearly so, usually spatulate or clawed at the base and, unless noted, papillose or lamellate inside; stamens diverging on all sides from the straight or slightly curved style; lvs. usually 3-5-nerved.

V. *ISOLIRION*. Species 47-56.

Perianth trumpet- or funnel-shaped, with oblanccolate segms., smooth inside, falcate only at the apex; stamens slightly curved, parallel with the style; lvs. cordate or heart-shaped with long petioles, many nerved.

VI. *CARDIOCRINUM*. Species 57-58.

Perianth campanulate-funnelform, with distinct and separate segms., horizontal or declined; stamens slightly declined, equalling or somewhat exceeding the curved style; stigma prominently 3-lobed.

VII. *NOTHOLIRION*. Species 59.SUBGENUS I. *EULIRION*.

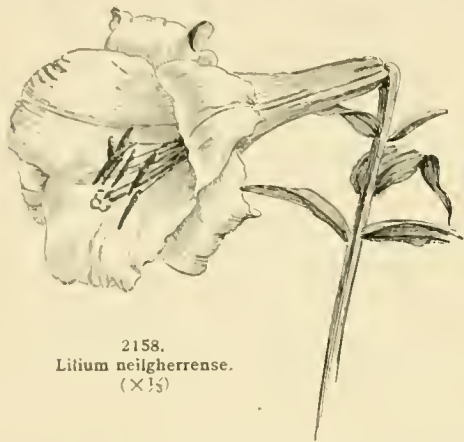
- A. Tube scarcely widened from base to middle.
 B. *Lvs. scattered, 1-3-nerved*..... 1. *philippinense*
 BB. *Lvs. scattered, 3-5-nerved*.....
 C. *Fls. pure white*..... 2. *longiflorum*
 CC. *Fls. white or yellow, tinged brown or purple*.
 D. *St. entirely green*.
 E. *Plant erect from the bulb*.... 3. *Wallichianum*
 EE. *Plant with parts creeping along under ground*..... 4. *neilgherrens*
 DD. *St. tinged brown-purple*.
 E. *Bearing bulblets*.
 F. *Burmese species*..... 5. *sulphureum*
 FF. *Chinese species*..... 6. *Sargentiae*
 EE. *Not bearing bulblets*..... 7. *regale*
 AA. Tube gradually narrowing from base to neck.
 B. *Lvs. scattered, with 3-5 or more nerves*.
 C. *Fls. pure white*..... 8. *candidum*
 CC. *Fls. white or yellow, tinged purple*.
 D. *Anthers reddish brown*.
 E. *Bulb globular*..... 9. *odorum*

1. *philippinense*, Baker. Bulb globular or slightly oval, 1-2 in. diam., white, often tinged yellow: st. smooth, slender, 1-2 ft. high, green, sometimes dotted purple: lvs. 30-40, horizontal, 3-5 in. long, $\frac{1}{8}$ - $\frac{1}{6}$ in. wide, upper ones slightly recurved: fls. usually solitary, rarely in pairs, 6-9 in. long, 4-6 in. wide, pure waxy white, tinged green near the base, delicately fragrant; anthers yellow. Late June, July. Philippine Isls. El. 3. B.M. 6250. I.H. 41:16. G.C. III. 30:47; 36:211. A.F. 23:907. Gng. 15:9. G.Z. 28, p. 145. Gn. 50:492.—Rather tender and capricious under cult.; in the northern states best suited for pots.

2. *longiflorum*, Thunb. JAPANESE EASTER LILY. LONG-TUBED WHITE LILY. TRUMPET LILY. Bulb 2-4 in. diam., sometimes nearly globular, but more often of a peculiar oblate form, all the scales terminating together at the top or apex, which is flattened, while the base is narrower or constricted, color white or yellow: st. stout, smooth, 1-3 ft. high, bright green, sometimes tinged reddish brown near the base: lvs. 20-40, horizontal, or the upper ones semi-erect, 3-5 in. long, $\frac{1}{2}$ - $\frac{1}{2}$ in. wide: fls. 1-10, 4-6 in. long, nearly as wide, pure waxy white, often tinged green near the base; deliciously fragrant; anthers yellow. July to early Aug. China, Formosa, Liu Kiu Isls. and other parts of Japan. El. 7. B.R. 560. L.B.C. 10:985. Gn. 48, p. 386; 60, p. 44; 71, p. 495. G.C. III. 50:462; 51:43. A.F. 11:1311; 12:1104. A.G. 19:709. Gn. M. 10:112. C.L.A. 12:533. G. 35:827. G.W. 3, p. 43. Var. *foliis albo-marginatis*, Hort., is similar, except the lvs. are paler green, edged creamy white, very rare. Var. *eximium*, Nichols. (*L. eximium*, Court., *L. floribundum*, Hort., and *L. Harrisii*, Carr.). BERMUDA EASTER LILY. A larger, stronger grower than the type, sometimes 4 ft. high, with 15-20 fls., 6-8 in. long. A.G. 18:297. A.F. 12:143. Gn. 30:124; 43, p. 165; 45, p. 215; 46, p. 73; 47, p. 172; 49, p. 481; 52, p. 217; 60, p. 99; 66, p. 369; 68, p. 26. F.R. 1:679. G.C. III. 22:91; 43:180. R.H. 1883, p. 211; 1912, p. 456. G. 15:727; 17:29; 22:257; 23:613. Gn. M. 3:30; 5:73. J.H. III. 69:233. G.M. 47:375. Var. *insulare*, Hort., is similar, but the perianth is said to be even longer. Magelhaes Archipelago, south of Japan. Gn. 61: suppl. Jan. 4. Var. *Wilsonii*, Hort. G. 11:131, var. *multiflorum*, Hort., A.F. 27:437; 35:477, and var. *gigantum*, Hort., G.M. 52:65, are all nearly the same as var. *eximium*, but the sts. of the latter are heavily tinged reddish brown. Var. *Jamesii*, Hort., a cross between the type and *L. Harrisii*, is not sufficiently distinct from either. Var. *Takesima*, Hort. (*L. Takesima*, Sieb.), sometimes called a distinct species, is evidently allied to *L. Brownii* and differs from the type in the st. being more heavily tinged and dotted brown, while the lvs. are longer and narrower and the fls. longer and not so widely expanded; when first opened there is a purplish brown midrib through the outside of each segm., while the 3 outer ones are also shaded chocolate. G.W. 15, p. 387. Var. *formosum*, Hort., G. 4:187; 36:325, G.Z. 26; p. 195, from the island of Formosa, and var. *liukiuensis*, Hort., from the Liu Kiu Isls., are similar, if not identical.—Although extensively grown as pot-plants for forcing, *L. longiflorum* and its vars. are seldom cult. in the open ground in the northern states. They are rather tender and, moreover, are not so permanent and long-lived as many others. After once flowering, the bulbs often have the exasperating habit of splitting up into 3 or 4

smaller ones, which require 2 or 3 years to bloom, or else they decay entirely, leaving a few small offsets.

3. *Wallichianum*, Schult. Bulb globular or slightly oval, 2-3 in. diam., with broad, thick, reddish purple or brownish scales slightly notched at the edges; st. smooth, green, 4-6 ft. high; lvs. 50-60, erect or semi-horizontal, lower ones 6-9 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide, upper ones shorter and wider; fls. usually solitary,



2158.
Lilium neilgherrense.
($\times \frac{1}{5}$)

sometimes 2-3 together, 6-9 in. long, nearly as wide, deliciously fragrant, with waxy, creamy white segms., tinged golden yellow at the base inside and green outside; anthers yellow. Aug., Sept. Himalaya region from Nepal to N. Burma. El. 4. B.M. 4561. Gn. 10:426. J.F. 1:105, 106, and p. 55. G.C. III. 28:10.—A magnificent species, but seldom cult. in this country.

4. *neilgherrense*, Wight (*L. Mëtzi*, Steud. *L. neilgherrense*, Lem.). Fig. 2158. Bulb globular, 2-3 in. diam., with broad, thick scales, white or yellow, tinged purple or brown; st. smooth, 2-4 ft. high, the underground part often creeping along horizontally a foot or more before coming to the surface; lvs. 30-40, erect, 2-4 in. long, $\frac{1}{2}$ -1 in. wide; fls. 1-3, 6-8 in. long, nearly as wide, with waxy segms. of a rich buff color inside, fading to cream, almost white on the edge, outside faintly tinged purple; anthers yellow; the fragrance is delicately aromatic and distinct from that of any other lily. Aug., Sept. Neilgherry Mts. of S. India. El. 6. F.S. 22:2266, 2267. B.M. 6332. Gn. 27:312. F.M. 1876:237. G.C. III. 30:53.—A beautiful species, but almost unknown in this country.

5. *sulphureum*, Baker (*L. Wallichianum* var. *superbum*, Hort.). Bulb similar to that of *L. Wallichianum* but with smooth edges; st. smooth, 4-8 ft. high, green, tinged and dotted purple, bearing bulbils in the upper lf.-axils; lvs. 100-150, thickly scattered, horizontal, 2-4 in. long, $\frac{1}{2}$ -1 in. wide; fls. 1-4, 5-7 in. long, nearly as wide, deliciously fragrant, with waxy segms. of a sulfur-yellow color, fading to creamy white and tinged purple outside with purple midribs; anthers reddish brown. Aug., Sept. N. and E. Burma. B.M. 7257. Gn. 51, p. 259 (as *L. ochroleucum*); 66, p. 229; 71, p. 528; 72, p. 523. R.H. 1895, p. 541; 1913:180. G.C. III. 40:199; 51:19. J.H. III. 43:83; 59:37.—A magnificent, stately species, but rarely cult. Succeeds best in pots.

6. *Sargentiae*, Wilson (*L. leucanthum*, Hort. *L. Brownii* var. *leucanthum*, Hort.). Bulb similar to that of *L. sulphureum*; st. stout, smooth, 4-8 ft. high, green, tinged and dotted purple, bearing bulbils in the upper lf.-axils; lvs. 100 or more, thickly scattered, horizontal, 2-4 in. long, $\frac{1}{2}$ -1 in. wide; fls. 1-10 (usually 3-6), 5-6 in. long, nearly as wide, fragrant, waxy white inside, tinged yellow near the throat, outside heavily

suffused reddish purple with deeper midribs; anthers reddish brown. Late July, Aug. W. China. Closely related to *L. sulphureum*; often confused with *L. Brownii* var. *leucanthum*, to which it bears no resemblance. G.C. III. 51:385 (desc.) Gn. 77, p. 442; 69:231. J.H. III. 68:537. G.M. 48:579. Gn. W. 22: suppl. Oct. 21.—A magnificent lily, hardly as far north as Boston.

7. *regale*, Wilson (*L. myriophyllum*, Hort., not Franch.). Bulb similar to that of *L. sulphureum*; st. 3-6 ft. high, smooth, stout, deep green, tinged and dotted purple; lvs. thickly scattered, 100 or more, deep green, horizontal, recurved, 3-6 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide; fls. 1-7 or more, 4-6 in. long, nearly as wide, deliciously fragrant, with waxy segms.; about a third of each one, near the base, inside, is bright canary-yellow, while the remainder of the interior is pure white, often suffused pink; outside they are white, tinged yellow at the base and with purple midribs, while the 3 outer ones are also heavily shaded purple; anthers reddish brown. July to early Aug. W. China. B.M. 8102. G.C. III. 38:328; 51:273; 53:416, 417. G.M. 55:416. Gn. 73, p. 397; 79, p. 27. F.S.R. 3, p. 331. C.L.A. 23:57. G. 32:57, 693; 35:537.—One of the most beautiful of all known lilies, the exquisite blending of tints and colors forming a charming contrast with the rich, deep green foliage. Highly recommended for general cult. both for pots and the open ground, where it is hardy, strong-growing and permanent as far north as Boston. *L. myriophyllum*, Franch., which is not in cult., differs in its oblate white bulb, its 3-nerved lvs., suberect nearly tubular fls., short pedicels and glabrous filaments.

8. *candidum*, Linn. ANNUNCIATION LILY. BOURBON LILY. LENT LILY. MADONNA LILY. ST. JOSEPH'S LILY. Bulb globular or nearly so, 2-4 in. diam., white, tinged pale yellow; st. 2-4 ft. high, smooth deep green; lvs. 60-100 or more, lower ones horizontal, 6-9 in. long, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. wide, appearing in autumn, upper ones gradually becoming smaller, those just below the infl. only 1 in. long, $\frac{1}{2}$ in. wide; fls. 3-20, 3-4 in. long and as wide, delicately fragrant, pure waxy white; anthers yellow. Late June, July. S. Eu. and S. W. Asia, from the island of Corsica to the Caucasus Mts. and N. Persia. El. 9. Gn. 45, p. 281; 53, p. 188; 56, p. 255; 66, p. 226; 71, p. 466; 74, p. 474; 79, p. 16. G.C. III. 21:161. G.M. 44:145; 51:698. Gng. 6:369; 13:5. F.E. 19:612. Gn. W. 14:41. G. 4:545. Gn.M. 4:28; 12:9.—Considered by many to be the lily of the Bible. It is of easy cult. in almost any soil or location and is also largely used for forcing. There are several varieties, all of which are rare, however, and none of them is superior to the type. Var. *foliis albo-marginatis*, Hort., has the lvs. broadly edged pale yellow. Var. *fiore-pleno*, Hort. (var. *monstruosum*, Hort., var. *spicatum*, Hort.), produces abortive fls. with white, dilated bracts; it is worth growing only as a curiosity. Var. *maculatum*, Hort. (var. *striatum*, Hort.), produces fls. which are streaked and veined purple on the outside; sometimes the lvs. also show the same variegation. Var. *peregrinum*, Linn. (var. *byzantinum*, Hort.), is of more slender growth than the type, with purple-tinged sts., narrower lvs. and narrower, longer perianth-segms. Var. *speciosum*, Hort., is of smaller growth than the type, with purple-tinged sts. and comes into bloom about 2 weeks later; otherwise it is similar.

9. *odorum*, Planch. (*L. Colchesteri*, Hort. *L. colchesterense*, Wallace). Fig. 2159. Bulb globular, 2-3 in. diam., white or pale yellow; st. smooth, 1-3 ft. high, glaucous-green, spotted purplish brown, darker at the base; lvs. 12-20, horizontal or semi-erect, 3-4 in. long, $\frac{3}{4}$ -1 in. wide, glaucous-green, tinged brown when young; fls. usually solitary, sometimes 2-3 together, 6-8 in. long, nearly as wide, with waxy segms., golden yellow inside, fading to creamy yellow, while the outside is tinged reddish brown; anthers reddish brown; the fragrance is rich

and delicious, similar to that of the Cape jasmine. July to early Aug. Japan, Korea and China. El. 14. B.M. 1591. L.B.C. 5:438. G.C. III. 43:316; 48:175. Gn.M. 2:174. Gn.W. 26:187. G.M. 44:467. G. 22:199. Also J. H. III. 62:221; G. 28:467; G.M. 50:58 (all as var. *Colchesteri*). Also G.C. III. 30:64; Gn. 66, p. 244 (as var. *colchesterense*). G.C. III. 30:54, and J.H. III. 43:63 (as var. *Alexandra*). (See supplementary list.)—A lily of many names, often confused with *L. Brownii*, *L. japonicum*, and so on. It is quite rare, but is of easy cult., both in pots and open ground.

10. *Bröwnii*, Poit. Bulb of the same size and peculiar oblate form as that of *L. longiflorum*, but usually tinged and dotted reddish purple: st. smooth, 2-3 ft. high, deep reddish brown at the base and bare of lvs. for 6-8 in., upper part deep green, tinged and spotted reddish brown: lvs. 25-50, horizontal or semi-erect, recurved, 3-5 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide, green, edged brown when young: fls. usually solitary, sometimes 2-4 together, 6-8 in. long, nearly as wide, delicately fragrant, with waxy segms. creamy white inside, fading to pure white and tinged yellow at the base; outside they are white, with purple midribs, while the 3 outer ones are also heavily tinged purple; anthers reddish brown. July, to early Aug. W. China. El. 8. Gn. 29:350 (as *L. japonicum*); 38, p. 173; 47, p. 97; 60, p. 201; 62, p. 299; 76, p. 552; 77, p. 94; 79, p. 15. G.C. III. 42:67. G. 10:161. Gn.W. 20:661. Gng. 4:193. F.S. 21:2248, 2193 (as *L. japonicum Colchesteri*).—Hardy and of easy cult., but the bulbs, like those of *L. longiflorum*, are very liable to decay if surplus water collects in the peculiar cup-like depression at the base of the scales. Especially good for pots. The var. *chloraster*, Hort., has narrower lvs. and the fls. are tinged green, not purple. Gn. 47:97 (as var. *leucanthum*). Var. *leucanthemum*, Hort., has entirely green sts. and yellow-tinted fls. B.M. 7722. G. 28:567; 31:561. G.C. III. 49:264. Both of these are very rare, while the vars. *platyphyllum*, Hort., and *viridulum*, Hort., which have been mentioned, are not in cult. Var. *kansuense*, Hort., is mentioned in recent horticultural literature.

11. *nepalense*, D. Don (*L. ochroleucum*, Wall.). Bulb similar to that of *L. neilgherrense*: st. smooth, 2-4 ft. high: lvs. 30-50, erect or nearly so, 2-4 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide: fls. 1-7, semi-horizontal or nearly pendulous, 4-5 in. long, nearly as wide, delicately fragrant, about half of each segm. at the base, inside, is bright, reddish purple, while the remainder of the interior is pale citron-yellow, next to the solid purple there are usually a few spots of the same color on the yellow background; anthers yellow. Aug., Sept. Himalaya Mts. from Nepal to N. Burma. El. 5. B.M. 7043. R.B. 22:3. Gn. 35:54; 78, p. 159. G.W. 2, p. 93. J.H. III. 54:349. Gn.W. 12:785.—Rarely seen in cult. except by specialists, and only suitable for pots.

12. *japonicum*, Thunb. (*L. Krämeri*, Hook. f.; see B. M. 7634. *L. japonicum var. roseum*, Hort.). Bulb globular or slightly spherical, 1-2 in. diam., white or pale yellow sometimes tinged red or purple: st. smooth, 2-4 ft. high, green, tinged and dotted deep purple, lower part bare of lvs.: lvs. 15-20, horizontal or semi-erect, 6-9 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide: fls. 1-7, 5-7 in. long and as wide, deliciously fragrant, usually of a bright pure rose-pink color, both inside and out, but sometimes deepening to rose-purple or fading to pale blush, nearly white; anthers red. June to early July. Japan. B.M. 6058. F.M. 1874:105. F. 1874:13. F.S. 20:2061-62. G. 18:95. Gn. 60, p. 45. G.Z. 18:113.—A beautiful lily, thought by some authorities to be a wild or natural hybrid between *L. auratum* (which the bulb and plant somewhat resembles) and another species, probably *L. odorum*. Unfortunately, it is delicate and capricious under cult., the bulbs decaying very easily from surplus moisture; although quite hardy, they can rarely be established

in the open ground for any length of time and are best grown in pots or coldframes.

13. *rubellum*, Baker. Bulb quite similar to that of *L. japonicum*, but more oval in shape: st. 1-2 ft. high, smooth, green, spotted and tinged purple, lower part bare of lvs.: lvs. 15-20, horizontal, 4-5 in. long, $\frac{3}{4}$ -1 in. wide: fls. 1-8, 3-4 in. long and as wide, fragrant, of the same color variations as *L. japonicum*; anthers yellow or orange. June to early July. Japan. Gn. 54:410; 60, p. 43; 77, p. 95. G.C. III. 23:335; 30:42; 46:168. G.M. 41:477; 44:466. A.G. 20:31. Gn.W. 20:854. Gn.M. 2:175. G. 28:245. F.R. 8:97.—Allied to *L. japonicum* but possesses a better constitution, being rather more robust and permanent.

14. *washingtonianum*, Kellogg (*L. Bartrami*, Nutt.). Bulb semi-rhizomatous, oblique, prolonged laterally to a length of 6-8 in., scales large, broad, loosely arranged, grayish white or pale yellow, sometimes tinged and dotted purple: st. stout, smooth, 3-6 ft. high: lvs. horizontal or semi-erect, glaucous-green, 3-4 in. long, $\frac{2}{3}$ -1 in. wide, usually in 6-9 whorls, each containing 5-12 lvs., with a few scattered ones above: fls. in racemes of 2-20, $2\frac{1}{2}$ -4 in. long, nearly as wide, deliciously fragrant, white, slightly tinged and dotted reddish purple or lilac inside and more heavily suffused purple outside; anthers yellow or orange. Late June, July. Calif., along the Sierra Nevada Mts. and Coast Range. El. 10. Gn. 20:484; 27, p. 344; 61, pp. 54, 55; 71, p. 139. J.H. III. 33:113.—A beautiful and stately species when well grown, but in the N. E. is rather capricious and often fails to succeed in the open ground. The var. *purpureum*, or var. *purpurascens*, Hort. (*L. purpureum*, Mast.), is of more slender growth and smaller in every way, 2-3 ft. high, with lvs. 1-2 in. long, while the fls. are semi-erect and borne in umbels of 4-8; color white, faintly tinged lilac and spotted purple internally when first opened, soon changing to uniform lilac-purple. El. 11. F. S. 19:1975-76. G.C. III. 30:59. C. L. A. 5:43.

Var. *rubescens*, Hort. (*L. rubescens*, Wats.), has a smaller, more globular bulb than the typical species, a more slender st. 3-5 ft. high, narrower lvs. and a raceme of 4-12 smaller, semi-erect fls., with more reflexed segms.; color white, tinged rose-pink, unspotted, changing to uniform rose-purple. Both these varieties are perhaps entitled to rank as distinct species. Var. *minus*, Hort., is mentioned. G. 29:137.

15. *Pärryi*, Wats. Bulb a scaly rhizome, 2-4 in. long, often irregular in shape, thickly covered with small scales, which are sometimes jointed and of a white or pale yellow color, rarely tinged pink or purple: st. slender, smooth, 2-5 ft. high: lvs. horizontal, 4-6 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide, lower ones usually whorled, upper ones scattered: fls. 1-10, 2-4 in. long, as wide, delicately fragrant, of pure lemon-yellow color, more or less spotted internally purplish brown; anthers orange-red. Late June, July. San Bernardino Mts. of S.



2159. *Lilium japonicum*. ($\times \frac{1}{2}$)

Calif. El. 12. B.M. 6650. L.H. 33:595. Gn. 18:652 (not typical); 49, p. 410; 60, p. 337. G.C. III. 18:209 (habit not correctly shown); 30:57; 55:217. G. 19:133. —A beautiful species, rather capricious and tender under cult., but usually succeeding well under the same conditions as *L. canadense* and *L. superbum*.

SUBGENUS II. ARCHELIRION.

- A. *Lvs. sessile*. 16. *tigrinum*
 AA. *Lvs. shortly stalked*.
 B. *Fls. white or pink*.
 C. *Borne horizontally*. 17. *auratum*
 CC. *Becoming nearly pendulous*. 18. *speciosum*
 BB. *Fls. reddish yellow*. 19. *Henryi*

16. *tigrinum*, Ker-Gawl (*L. sinense*, Hort.). TIGER LILY. Fig. 2160. Bulb spherical, 2–4 in. diam., white or pale yellow, sometimes tinged red or purple; st. stout, 2–4 ft. high, deep purplish brown, covered with white or grayish cobweb-like down and producing deep purple bulbils in the upper lf.-axils; lvs. 75–100 or more, deep green, 2–4 in. long, $\frac{1}{4}$ – $\frac{1}{2}$ in. wide; fls. 1–15, 3–5 in. diam., with bright salmon-red segms.; spotted purplish black and reflexed to the st.; anthers red. Aug., Sept. China and Japan. El. 38. B.M. 1237. F. 1873: 13. G.M. 44:468. —One of the hardiest, most permanent and most easily grown of all lilies, and furthermore, one of the most beautiful. It has escaped and become naturalized in parts of Maine and N. Y. Var. *flôre-plêno*, Hort. (var. *plenescens*, Waugh), is identical, except the fls. are double. It is the only desirable double-fl. lily in cult. R.H. 1873:10. F. 1871:25. F.S. 19:1995. G.Z. 20:17. Var. *splendens*, Hort. (var. *Leopoldii*, Hort.), is a stronger grower than the type, and larger in every way, often growing 6–7 ft. high and bearing as many as 25 fls. which open later. Gn.W. 20:907. Gn. 27:152. F.S. 19:1931–32 (too dark-colored). Var. *Fôrtunei*, Hort. (*L. Fôrtunei*, Lindl.), is similar, but the lvs. and fls. are paler in color and the sts. are smooth, not downy. G.M. 51:778. Gn. 74, p. 586, 77, p. 73. The var. *jocundum*, Hort., or var. *Lishmanii*, Moore, is identical with *L. Maximowiczii*.

17. *auratum*, Lindl. GOLDEN-BANDED LILY. GOLDEN-RAYED LILY. QUEEN OF LILIES. Fig. 2161. Bulb spherical or nearly globular, 3–5 in. diam., with broad, thick scales, white or pale yellow, sometimes tinged red or purple; st. 3–6 ft. high, smooth, glaucous-green, often tinged purple, bare of lvs. for 6–9 in. above the surface; lvs. 20–50, horizontal, 3–6 in. long, $\frac{1}{2}$ –1 in. wide; fls. 1–15, 6–10 in. diam., deliciously fragrant, white spotted crimson, with a yellow band or midrib extending the whole length of each segm.; anthers red. Blooms late July, Aug. Japan. El. 15. Gn. 16:212; 39, p. 455; 50, p. 148; 60, p. 48; 64, p. 196; 65, p. 41; 70, p. 125; 71, pp. 395, 515, 550; 72, p. 443; 75, p. 138; 79, p. 4. G.C. III. 25:303; 54:269. G.M. 44:464, 593; 55:91. G. 20:503; 35:597. J.H. III. 53:37; 68:43. A.F. 7:43; 35:105. C.L.A. 12: 532; 14:45. H.F. II. 6:101. G.W. 6, p. 158. G.Z. 9:2. R.B. 21:25. F.M. 1871:514. R.H. 1867:371; 1875:10. B.M. 5338. A.G. 20:525. —Rather capricious under cult., often disappearing in a year or two, but so gorgeously beautiful that it should be generally grown, even if

frequent renewal is necessary. One of the best lilies for pots. Var. *platyphylum*, Hort. (var. *macrandrum*, Hort.), is superior to the type, being a larger, stronger grower, sometimes 8–10 ft. high, with fls. a foot or more across, of the same color, but only slightly spotted. G. 30:609; 35:645; 36:715. Gn. 63, p. 95. Gn.W. 20:1027. Var.



2161.
Lilium auratum.
($\times \frac{1}{4}$)

rûbro-vittatum, Hort., has a wide crimson band through each segm. and numerous crimson spots; it is thought by some to be a hybrid between *L. auratum* and *L. speciosum*, as it resembles the latter more in bulb and habit of growth. Var. *cruentum*, Hort., is quite similar. Var. *rûbro-pictum*, Hort., produces white fls. spotted crimson, while the band through each segm. is yellow at its base and red at the end. Var. *pictum*, Hort., is similar, but the yellow portion of the band is absent. Var. *virginale*, Hort., resembles the type, except the spots are yellow; there is also an unspotted form, known as *virginale album*, Hort. Var. *Wittei*, Hort. (*L. Wittei*, Suring.), produces fls. of the same color as the latter, but the segms. are shorter and broader than those of any other variety, and, unlike all others, they are smooth, not papillose, inside. El. 16. Var. *Tashiroi*, Hort., is described as a dwarf, large-fl. form of the type.

18. *speciosum*, Thunb. SNOWY LILY. Fig. 2162. Often erroneously called *L. lancifolium*, a synonym of *L. elegans*. Bulb globular, 3–4 in. diam., reddish purple or brownish, rarely yellow or orange; scales broad and thick; st. 2–4 ft. high, smooth, green, often tinged and dotted purple; lvs. 12–25 or more, horizontal, 3–6 in. long, $\frac{1}{2}$ – $1\frac{1}{2}$ in. wide; fls. 1–10, 4–6 in. diam., delicately fragrant, with segms. often reflexed to the st.; they are white, suffused rose-pink in the center and spotted blood-red, with a green stripe at the base; anthers red. Late Aug., Sept. Japan. El. 13. B.M. 3785. B.R. 2000. Gn. 25:82; 33, p. 289; 45:90, and p. 91; 47, p. 19; 60, p. 408; 63, p. 108. R.H. 1843:492. G.C. III. 30:241. G. 5:457. —One of the most beautiful and satisfactory of all lilies, robust, permanent, easily grown and highly recommended for both pots and open ground. Vars. *roseum*, Hort., and *rûbrum*, Hort., often catalogued as distinct, are really very similar to the type, but the fls. of the latter are rather deeper in color. Gn. 36:434; 60, p. 313; 70, p. 187. G.M. 41:469. Gn.M. 2:115. Gn.W. 15:7. G.W. 15, p. 596. Var. *Kaëmpferi*, Hort., var. *purpuratum*,

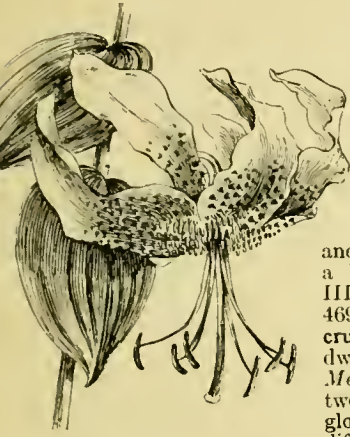


2160. *Lilium tigrinum*. ($\times \frac{1}{4}$)

Hort., and var. *Schrymákersi*, Hort., are all similar to var. *rubrum*. Var. *macrânthum* and var. *multiflorum*, Hort., are also similar, but are of larger, stronger growth and more free-flowering. Var. *Melpómene*, Hort., is of somewhat different habit of growth than the type and has much deeper-colored fls.

which are of a rich carmine-erimson, spotted blood-red and narrowly edged white. Var. *magnificum*, Hort., is closely allied to var. *Melpómene*, but is larger in every way, of stronger growth

and comes into bloom a little earlier. J.H. III. 68:125. G. 27: 469; 33:689, 692. Var. *cruentum*, Hort., is a dwarfier form of var. *Melpómene*, flowering two weeks later. Var. *gloriosoides*, Baker, differs from the type in its narrower lvs., much



2162. *Lilium speciosum*. ($\times \frac{1}{3}$)

twisted gloriosa-like segms. and scarlet spots. Var. *album*, Hort. (var. *albiflorum*, Hook.), has deep brown bulbs, brown-tinged sts. and buds and unspotted white fls. slightly suffused pink; anthers reddish brown. P.M. S:127. Gn.W. 23, suppl. May 19. Var. *album novum*, Hort., has pure white fls. with yellow anthers. Var. *Kraëtzeri*, Duch., often sold as var. *album*, is quite distinct, differing in its yellow bulbs, entirely green st., more pointed, brighter green lvs. and green-tinged buds; the fls. are pure white with a pale green stripe halfway down the center of each segm. and reddish brown anthers. G. 11:69; 15:97. Var. *vestale*, Hort., is similar. Var. *punctatum*, Lem., has yellow bulbs, entirely green sts. and white or pale blush fls. spotted rosy crimson. It is of more delicate constitution than the other varieties. Var. *præcox*, Hort., is similar, if not identical. There are also several other horticultural forms, but they are not sufficiently distinct to be recognized.

19. *Hénryi*, Baker. Fig. 2163. Bulb similar to that of *L. speciosum*, but often larger, deep reddish purple; st. smooth, 4-8 ft. high, deep green, heavily tinged and spotted purplish brown; lvs. 60-100, horizontal, 3-6 in. long, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. wide, upper ones shorter and recurved; fls. 1-20, 3-4 in. diam., inodorous, bright orange-yellow, slightly spotted reddish brown and with a green band at the base of each segm.; anthers orange-red. Aug., Sept. Cent. China. B.M. 7177 (too light-colored). Gn. 40:422; 55, p. 233; 60, p. 336. G.C. III. 8:380. J.H. III. 42:131. R.H. 1903:232. G. 35:655.—One of the very best of all lilies for general cult., hardy, robust, long-lived and easily grown in almost any soil and situation. Sometimes called the yellow *L. speciosum*; although it resembles that species in bulb and form of fls., it is entirely distinct in habit of growth.

SUBGENUS III. MARTAGON.

- A. Lvs. mostly verticillate, usually 3-5-nerved.
 B. Species American.
 C. Bulbs rhizomatous.
 DD. Eastern species. 20. *superbum*
 DD. Southern species. 21. *carolinianum*
 DDD. Western species.
 E. Broad-ld. 22. *pardalinum*
 EE. Narrow-ld. 23. *Roetzlii*
 CC. Bulbs not strictly rhizomatous.
 D. Form oblique. 24. *Humboldtii*
 DD. Form globular.

- E. Fls. yellow. 25. *columbianum*
 EE. Fls. pink. 26. *Kelloggii*
 BB. Species Old World.
 C. Fls. purple or white. 27. *Martagon*
 CC. Fls. yellow.
 D. St. 2 ft. or less high 28. *avenaceum*
 DD. St. 3 ft. or more high 29. *Hansonii*
 AA. Lvs. scattered.
 B. The lvs. many-nerved.
 C. Himalayan species. 30. *polyphyllum*
 CC. Persian species. 31. *monadelphum*
 CCC. European species. 32. *carniolicum*
 BB. The lvs. 1- or few-nerved.
 C. Species European.
 D. Fls. red. [cum
 E. From Greece. 33. *chalcedoni-*
 EE. From Alpine regions. 34. *pomponium*
 DD. Fls. yellow. 35. *pyrenaicum*
 CC. Species Asiatic.
 D. Fls. yellow. 36. *Leichtlinii*
 DD. Fls. red. [wiczii
 E. From Japan. 37. *Maximo-*
 FF. St. often 5 ft. high. 38. *callosum*
 FF. St. not over 2 ft. high. 39. *tenuifolium*
 EE. From Siberia. 39. *tenuifolium*
 EEE. From China. 40. *sutchuenense*
 CCC. Species hybrid 41. *testaceum*

20. *superbum*, Linn. AMERICAN TURK'S-CAP LILY. SWAMP LILY. Fig. 2164. Bulbs rhizomatous, borne an inch or two apart on stout rhizomes, globular or nearly so, 1-2 in. diam., white, often tinged red or pink; scales small, thick, sometimes jointed; st. stout, smooth, 3-8 ft. high, green, sometimes tinged purple, usually bare of lvs. for 5-6 in. above the surface; lvs. horizontal, 2-5 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide, usually in 3 or 4 whorls of 4-10 lvs. each, with a few scattered ones above; fls. 1-40, 3-4 in. diam., with segms. reflexed to the st., of a brilliant orange-scarlet, shaded yellow and spotted purplish brown at the base; anthers red. Late July to early Sept. New Bruns. to Ont., Minn., Mo., and Ga. El. 26. B.M. 936. L.B.C. 4:335 (as *L. autumnale*). Gn. 30:8 and p. 9; 38:506. Gn.W. 22, suppl. Nov. 4. —The most magnificent and showy of native North American species, well worthy of extensive cult. It is considerably variable and there are intermediate forms between *L. superbum* and *L. canadense*.

21. *carolinianum*, Michx. (*L. autumnale*, Lodd. *L. Michauxii*, Poir. *L. Michauxianum*, Schult. *L. superbum* var. *carolinianum*, Chapm.). SOUTHERN SWAMP LILY. Allied to *L. superbum*, but the bulbs more nearly resemble those of *L. pardalinum*: st. smooth, slender, 2-4 ft. high; lvs. horizontal, deep green, 2-3 in. long, $\frac{3}{4}$ -1 in. wide, usually in 5-6 whorls, with a few scattered ones above and below; fls. 1-3, 3-4 in. diam., delicately fragrant, of the same color as *L. superbum*, but with a paler, almost white throat. Late July, Aug. Va. to Fla. and La.—Of easy cult., but rather more tender and not so desirable as *L. superbum*.



2163. *Lilium Henryi*. ($\times \frac{1}{4}$)

22. *pardalinum*, Kellogg. LEOPARD LILY. PANTHER LILY. Fig. 2165. Bulb a scaly rhizome, quite similar to that of *L. Parryi*, but more branching and irregular in form: st. 3-6 ft. high, smooth, pale green: lvs. horizontal, 3-4 in. long, $\frac{3}{4}$ -1 in. wide, usually in 3 or 4 whorls of 9-15 lvs. each, with a few scattered ones above and below: fls. 1-30, 2-4 in. diam. with segms. reflexed to the st., about half of each one, at the base, is bright yellow, spotted brownish purple, while the remainder, at the end is bright orange-scarlet; anthers red. Late June to early Aug. Sierra Nevada Mts. of Calif. El. 28, 29. F.M. 1872:33 (as *L. washingtonianum*). Gn. 20:526. G. 32:463. J.H. III. 49:147; 51:79. Gn. M. 9:236. —This lily is the best and most easily grown Calif. species for general cult.; hardy, robust, and permanent. Var. *angustifolium*, Kellogg, is identical, except the lvs. are much narrower, and it is of more slender growth: it is sometimes confused with *L. Roezlii*. Var. *californicum*, Hort. (*L. californicum*, Lindl.), has smaller lvs., mostly scattered, and larger, more richly colored fls. G.C. III. 30:43. Var. *pallidifolium*, Baker (var. *puberulum*, Leicht.), has paler green lvs. and smaller, paler-colored fls. than those of the type, not so thickly spotted. Var. *Robinsonianum*, Moore, is a stronger grower than the type, sometimes 8-9 ft. high, with mostly scattered lvs. and larger, more richly colored fls. Var. *luteum*, Hort., produces pure yellow fls., spotted brownish purple; in other respects it is the same as the type.—There are also several

tipped red or scarlet and spotted brownish purple; anthers red. Late June to early Aug. Santa Cruz Mts. of Calif.—Allied to *L. pardalinum* and of the same easy cult.

24. *Humboldtii*, Roezl & Leicht. (*L. Bloomerianum*, Kellogg). Fig. 2166. Bulb semi-rhizomatous, oblique, somewhat similar to that of *L. washingtonianum*, but with larger, broader scales: st. stout, 4-6 ft. high, smooth or slightly pubescent, deep green tinged and spotted purplish brown, clothed with lvs. from the ground upward: lvs. horizontal, glaucous-green, 3-5 in. long, $\frac{3}{4}$ -1 in. wide, usually in 4-5 whorls of 10-15 lvs. each: fls. 1-30, 4-5 in. diam., bright orange-yellow, spotted deep purple-brown;



2166. *Lilium Humboldtii*. ($\times \frac{1}{3}$)

anthers red. Late June to early Aug. Sierra Nevada Mts. of Calif. El. 32. F.S. 19:1973-34. Gn. 20:568. J.H. III. 42:177; 62:167. G. 2:243; 33:121. C.L.A. 5:45.—A magnificent species, very stately and beautiful; although rather capricious under cult., it usually succeeds fairly well. Var. *magnificum*, Hort., is even superior, being a stronger, more robust grower, often 8 or 9 ft. high, with



2165. *Lilium pardalinum*. ($\times \frac{1}{3}$)

other rather indistinct so-called vars. and an unnamed hybrid between *L. pardalinum* and *L. Humboldtii*. Another hybrid between *L. pardalinum* and *L. Parryi*, called *L. Burbankii*, Hort., produces fls. resembling those of the

larger, more richly colored fls., often tinged reddish purple. Var. *puberulum*, Hort. (*L. puberulum*, Duch.), is identical with the type, except the st. and under side of the lvs. are more densely pubescent. Var. *ocellatum*, Kellogg, from the island of Santa Rosa, has a smaller, more globular bulb and brighter green lvs. than the type; the fls. are of the same color, but each purple spot is surrounded with a red circle or eye.

25. *columbianum*, Hanson (*L. nitidum*, Hort. *L. oregonense*, Hort.). Bulb similar to that of *L. Humboldtii*, but smaller and more globular: st. smooth, 2-4 ft. high; lvs. horizontal, $1\frac{1}{2}$ -3 in. long, upper ones scattered, lower ones in whorls of 4-5: fls. 1-12, 2-3 in. diam., bright orange-yellow, spotted purplish brown; anthers red. Late June to early Aug. Ore., Wash., and Brit. Col.—Smaller in every way, but closely related to *L. Humboldtii* and perhaps should only be ranked as a variety of it.

26. *Kelloggii*, Purdy. Bulb similar to that of *L. columbianum*: st. smooth, slender, 2-4 ft. high: lvs. mostly verticillate, partly scattered: fls. 1-15, $1\frac{1}{2}$ -2 in. diam., delicately fragrant, with segms. reflexed to the st.; color pink, spotted purplish black, changing to deeper rosy purple; anthers orange or red. Late June, July. N. W. Calif. Gn. 59, p. 330; 62, p. 200; 64, p. 16.—Very dainty and graceful.



2164. *Lilium superbum*. ($\times \frac{1}{2}$)

former in color and the latter in size and shape. G.M. 54:273. Closely allied to *L. pardalinum* is *L. parviflorum*, Hook. (*L. Saggi*, Nutt., *L. pardalinum* var. *minus*, Hort.), but the fls., which are of the same color, are smaller and are solitary or 2 or 3 are borne together. June, July. Vancouver Isl. to N. Calif. along the seacoast. Rather capricious under cult.

23. *Roezlii*, Regel (*L. Hartwegii*, Baker). Bulb similar to that of *L. pardalinum*: st. smooth, 2-5 ft. high: lvs. horizontal, 2-5 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide, usually scattered, sometimes a few of the upper or middle ones whorled: fls. 1-10, 2-3 in. diam., bright orange-yellow

27. *Martagon*, Linn. EUROPEAN TURK'S-CAP LILY. TURBAN LILY. Fig. 2167. Bulb oval, 2-3 in. long, 1-2 in. wide, bright yellow; scales thick, narrow, sharply pointed: st. 3-6 ft. high, smooth, or upper part slightly pubescent, green, often spotted purple: lvs. horizontal, deep green, 3-6 in. long, 1-1½ in. wide, usually in 2-4



2167. *Lilium Martagon*. ($\times \frac{1}{2}$)

whorls of 6-9 lvs. each, with a few scattered ones above: fls. 3-20, 2-3 in. diam., dull claret-purple, spotted purplish black; segms. thick, waxy, reflexed to the st. and slightly papillose at the base; anthers red; the fls. emit a nauseous, disagreeable odor. Late June, July. Cent. and S. Eu. from Spain to S. W. Siberia. El. 33. B.M. 872 (as *L. pennsylvanicum*); 1634. F.S. 20:2127. F.M. 1874:136. Gn. 23:32; 38, p. 393; 44:260 (as *L. Dalhansonii*). Var. *hirsutum*, Hort., is identical, except the sts. are more densely pubescent. Var. *flöre-pléno*,

Hort., produces double or semi-double fls. Var. *dalmaticum*, Hort. (*L. dalmaticum*, Malay), from Dalmatia, often grows 6-7 ft. high, with 5-7 whorls of lvs.: and 12-40 fls. which are of a deeper, richer purple, almost black, and only slightly spotted; the buds are enveloped in white, cottony down. Var. *Cattaneæ*, Hort., is almost identical, but the fls. are slightly paler in color. Var. *album*, Hort. (var. *glabrum*, Spreng.), produces pure white fls. with yellow anthers; the sts. are smooth and the lvs. brighter green than those of the type. G.C. III. 54:63.—There are also varieties with flesh- and lilac-colored fls. All the forms of *L. Martagon* are hardy, robust and of the easiest cult., but var. *album* and var. *dalmaticum* are far superior to the type.

28. *avenaceum*, Fisch. Bulb globular, 1-1½ in. diam., bright yellow, rarely tinged pink or purple; scales long, narrow, sharply pointed and jointed, the upper part, when broken off, resembling oats, whence the specific name: st. 1½-2 ft. high, smooth, bare of lvs. near the base: lvs. horizontal or semi-erect, 3-4 in. long, ½-1 in. wide, usually in 1 or 2 whorls of 6-9 lvs. each near middle of st. with a few scattered ones above: fls. 2-10, slightly fragrant, bright orange-yellow shaded red and more or less spotted deep purple; anthers red. June, early July. Manchuria, Kamchatka, Kurile Isls. and N. Japan. Gn. 24, p. 85.—Very rare and only desirable for collectors or specialists. The bulbs are delicate and easily break to pieces when handling.

29. *Hansonii*, Leicht. GOLDEN TURK'S-CAP LILY. JAPANESE TURK'S-CAP LILY. Fig. 2172. Bulb nearly globular, 2-3 in. diam., white or pale yellow, often tinged purple: st. smooth, 3-5 ft. high: lvs. horizontal, 4-5 in. long, ¾-1 in. wide, usually in 1-3 whorls near middle of st. with a few scattered ones above and below: fls. 1-10, 1½-2½ in. diam., slightly fragrant, with thick, waxy segms. of a bright golden yellow, spotted purplish brown; anthers orange-red. June, early July. Japan. El. 34. B.M. 6126 (as *L. maculatum*). Gn. 29, p. 287. R.H. 1883, p. 296. Gn.W. 22, suppl. April 8.—One of the best and most beautiful lilies for general cult., easily grown, robust and permanent. *L. Märhan*, Hort., is a garden hybrid between *L. Martagon* var. *album* and *L. Hansonii*; it resembles the former in habit of growth, but the fls. are of the same shape, size and

thick, waxy texture as those of the latter; color bright orange-yellow, veined, shaded and spotted reddish brown. A similar hybrid between *L. Martagon* var. *dalmaticum* and *L. Hansonii* is known as *L. Dalhansonii*, Hort. The fls. are not so bright in color, however.

30. *polyphyllum*, D. Don (*L. punctatum*, Jacquem.). Bulb oblong, 2-3 in. long, 1-1½ in. wide, with long, narrow, white scales, closely clasped together: st. smooth, 2-4 ft. high: lvs. 40-60, scattered, or the lower ones rarely whorled, erect, 4-5 in. long, ½-¾ in. wide: fls. 1-10, 1½-2 in. diam., deliciously fragrant, pale creamy yellow, tinged and dotted purple; anthers red. June, July. W. Himalayas. I.H. 32:565.—Very rare and only suitable for specialists.

31. *monadelphum*, Marsh & Bieb. (*L. colchicum*, Stev. *L. Loddigesianum*, Roetz & Schult.). Bulb quite similar to that of *L. Martagon*, but often larger and tinged purple: st. stout, 3-6 ft. high, usually slightly pubescent: lvs. 30-40, horizontal or semi-erect, 2-4 in. long, ½-1 in. wide: fls. 1-30, 3-5 in. diam., with waxy segms. of a rich golden yellow sometimes tinged purple and slightly, or not at all, spotted deep purple; anthers greenish or orange; the odor is rather disagreeable. June, early July. Caucasus Mts. and N. Persia. El. 36, 37. B.M. 1405. Gn. 75, p. 320. G.C. III. 16:129. Gn.W. 22:528. J.F. 2:204.—One of the most stately and beautiful of all lilies, succeeding well in almost any soil or situation and highly recommended for general cult. Var. *Szovitzianum*, Hort. (*L. Szovitzianum*, Fisch. & Lall.). Produces larger fls. with broader, less reflexed segms. of a lemon- or canary-yellow color, more thickly dotted purple and with reddish brown anthers; the filaments are entirely free or separate, whereas in the type they are supposed to be joined or united at their base, although this is not always the case.



2168. *Lilium pomponium*. ($\times \frac{1}{2}$)

Gn. 9:204; 39:242; 59, p. 407; 64, p. 316. G.C. III. 48:37. Gn.W. 21:522. G. 4:295; 27:373; 32:783. Var. *Lédebouri*, Baker, resembles the type, but is dwarfer, with 80-100 narrower lvs. and narrower perianth-segms.

32. *carniolicum*, Bernh. Bulb oval, 1½-2 in. long, 1-1½ in. wide, white or pale yellow, tinged red or

purple; scales broad, closely imbricated: st. 2-3 ft. high, green, slightly pubescent: lvs. 30-40, erect or nearly so, 2-3 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide: fls. 1-10, $1\frac{1}{2}$ -2 in. diam., orange-red, dotted purple-black; segms. waxy, reflexed to the st. and papillose inside; anthers orange; the odor is rich and heavy but not unpleasant. June, early July. Carniola, Bosnia, Dalmatia and vicinity. El. 45.—An easily grown species, but rarely seen in cult. There is also an unspotted variety, var. *unicolor*, Hort.

33. *chalcedonicum*, Linn. (*L. rubrum*, Parkin.). SCARLET TURK'S-CAP LILY. Bulb similar to that of *L. monadelphum*: st. 2-4 ft. high, green, tinged purple, covered with white down: lvs. 100 or more, lower ones horizontal, 2-6 in. long, $\frac{1}{6}$ - $\frac{1}{4}$ in. wide, upper ones smaller and more erect: fls. 3-6 or more, 2-3 in. diam., brilliant vermilion-scarlet, rarely slightly dotted purple; segms. thick and waxy, reflexed to the st. and papillose at the base; anthers scarlet; the odor is rather disagreeable. July, early Aug. Greece and the Ionian Is. El. 43. F.S. 21:2160. B.M. 30. F.W. 1876:193. Var. *maculatum*, Hort. (var. *excelsum*, Hort., var.



2169. *Lilium canadense*. ($\times \frac{1}{2}$)

majus, Hort.), is a larger, stronger grower, while the fls. are usually solitary and more thickly dotted purple; very rare. Both are hardy and of easy cult. and should be more generally grown.

34. *pompomium*, Linn. (*L. rubrum*, Lamb.). LITTLE TURK'S-CAP LILY. Fig. 2168. Bulb similar to that of *L. Martagon*: st. $1\frac{1}{2}$ -3 ft. high, furrowed or striated: lvs. 100 or more, lower ones horizontal, 2-4 in. long, $\frac{1}{6}$ - $\frac{1}{3}$ in. wide, upper ones smaller and more erect: fls. 1-15, $1\frac{1}{2}$ -2 in. diam., brilliant scarlet, dotted purplish black; segms. thick and waxy, reflexed to the st. and thickly papillose at the base; anthers scarlet. June, early July. Alps of S. France and N. Italy. El. 46. Gn. 20:420. G.C. III. 8:51. Gn.W. 20:675. G.W. 3, p. 356.—A graceful handsome species of easy cult., but the strong, nauseous odor of the fls. is a factor against its popularity. The var. *verum*, Hort., is similar, but the lvs., when first unfolding are twisted or curled like a sickle and slightly edged white.

35. *pyrenaicum*, Gouan (*L. flavum*, Lamb. *L. pompomium* var. *bileum*, Hort. *L. pompomium* var. *pyrenaicum*, Baker). YELLOW TURK'S-CAP LILY. Resembles *L. pompomium*, to which it is closely related, but often grows 4 ft. high, with larger bulbs, wider lvs. and larger

fls. of a pale lemon-yellow, dotted purplish black; anthers red. June, early July. Pyrenees Mts. of S. France and N. Spain. El. 47. There is an unspotted var. *unicolor*, Hort., and also another var. *aureum*, Hort., with spotted fls. of a brighter, deeper golden yellow color.—*L. Janka*, Kern., although found in Transylvania, 1,000 miles from the habitat of *L. pyrenaicum*, is very similar to it, but often grows taller, with slightly larger fls. and greenish yellow anthers, while the odor, instead of being nauseous, is quite agreeable, resembling honey.

36. *Leichtlinii*, Hook. Bulb similar to that of *L. tigrinum*, but smaller and never tinged red or purple: st. 2-4 ft. high, smooth, green shaded brownish purple, the underground part often running along horizontally a foot or more before coming to the surface: lvs. 30-40, horizontal or semi-erect, 2-5 in. long, $\frac{1}{4}$ - $\frac{1}{3}$ in. wide: fls. 1-20, 3-4 in. diam., with segms. reflexed to the st., of a bright lemon-yellow, spotted purple-black; anthers reddish brown. Late July, Aug. Japan. El. 39. F.W. 1869:65. G. 15:319. Gn.W. 20:908.—A very beautiful lily, but is rather capricious and often difficult to establish in the open ground. The var. *majus*, Wilson, is of larger growth, often 5 ft. high, with lvs. 6-7 in. long.

37. *Maximowiczii*, Regel (*L. pseudo-tigrinum*, Carr. *L. tigrinum* var. *jocundum*, Hort. *L. tigrinum* var. *Lishmannii*, Moore). Bulb similar to that of *L. Leichtlinii*: st. 3-5 ft. high, green, slightly tinged and spotted purple, smooth or slightly pubescent: lvs. 100 or more, horizontal, 2-4 in. long, $\frac{1}{4}$ - $\frac{1}{3}$ in. wide: fls. 1-12, 3-4 in. diam., soft salmon-red spotted purplish black; segms. reflexed to the st. and papillose at the base; anthers red. Aug., early Sept. China, Japan and the Liu Kiu Is. El. 40. B.M. 5673. F.S. 17:1736 (yellow variety). L.H. 15:540. R.H. 1867:410. Gn. 21:236 (yellow variety); 42, p. 193 (not typical). Gn. W. 25:619 (as *L. Leichtlinii* var. *Maximowiczii*).—Often called the red *L. Leichtlinii* and thought by some authorities to be a natural hybrid between that species and *L. tigrinum*. Unlike the former, the st. rises erect from the bulb and no bulbils are borne in the lf.-axils, as in *L. tigrinum*.

38. *callosum*, Sieb. Bulb globular, 1-2 in. diam., white or pale yellow: st. smooth, 1-2 ft. high: lvs. 30-40, erect, 2-4 in. long, $\frac{1}{12}$ - $\frac{1}{6}$ in. wide: fls. 1-8, $1\frac{1}{2}$ -2 in. diam., bright scarlet, usually slightly dotted purple-black; anthers red or scarlet: at the junction of each fl.-bearing st. or pedicel with the main st., there are 2 thick, blunt, callous bracts, whence the specific name. June, early July. Japan and the Loo Choo Is.—Very rare and only desirable for specialists. *L. stenophyllum*, Baker, from E. Siberia, resembles *L. callosum*, but the bulb is more oval, the st. stouter and taller, the lvs. larger and broader and the perianth-segms. narrower.

39. *tenuifolium*, Fisch. (*L. linifolium*, Hort. *L. pumilum*, DC. *L. puniceum*, Sieb. & De Vr.). CORAL LILY. FERN-LEAVED LILY. TOM THUMB LILY. TINY LILY. Bulb oblong, 1-2 in. long, $\frac{1}{2}$ -1 in. wide, white or pale yellow sometimes tinged pink; scales few, large, closely clasped together: st. 1-2 ft. high, slender, smooth, bare of lvs. for 2-3 in. above the surface: lvs. 40-60, erect or semi-horizontal, 1-2 in. long, $\frac{1}{12}$ - $\frac{1}{6}$ in. wide: fls. 1-15, $1\frac{1}{2}$ -2 in. diam., with waxy segms. reflexed to the st. and of a brilliant scarlet, rarely slightly dotted purple and lighter at the base; anthers scarlet or red. June, early July. S. Siberia and N. China. El. 42. B.M. 3140. L.B.C. 4:358. G.M. 45:443. J.H. III. 62:572.—A handsome, graceful species and the brightest in color of all. Although easily grown it is not very long-lived, as a rule, and must be frequently renewed. Good for rock-gardens and pots. The var. *Golden Gleam*, Hort., is a taller grower, often 3 ft. high and the fls. are bright, pure golden yellow; it is said to be a hybrid between *L. Martagon* var. *album* and *L. tenuifolium*, but resembles the latter in growth,

and the two form a splendid contrast when planted together.

40. *sutchuenense*, Franch. Bulb globular, 1-2 in. diam., with white, closely imbricated scales: st. 3-5 ft. high, the underground part running along horizontally before coming to the surface: lvs. thickly scattered, linear, deep green: fls. 1-20, pendulous, with reflexed orange-red segms. spotted purplish black; anthers red. June, July. Sutchuen, W. China. B.M. 7715. G.C. III. 38:90; 54:115. G.M. 48:501. G.W. 11, p. 114. J.H. III. 51:130. G. 31:243. A.F. 29:154. F.S.R. 3, p. 329.—Said to be allied to *L. tenuifolium*.

41. *testaceum*, Lindl. (*L. excelsum*, Hort. *L. Isabellinum*, Kunze). NANKEN LILY. Bulb similar to that of *L. candidum*: st. 3-6 ft. high, green, tinged purple-brown, slightly pubescent: lvs. 60-100, lower ones horizontal or nearly so, 3-4 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide, upper ones smaller and more erect: fls. 1-12, 2-3 in. diam., deliciously fragrant, of a pale, delicate creamy buff or nankeen-yellow, often flushed pink and rarely slightly dotted red, segms. reflexed to the st. and slightly papillose at the base; anthers red. Late June, July. Unknown in a wild state; probably a garden hybrid between *L. candidum* and *L. chalcedonicum*. El. 44. B.R. 29:11 (too highly colored). P.M. 10:221. Gn. 60, pp. 46, 153; 62, p. 322; 66, p. 399; 71, p. 519. G.C. III. 55:33. G. 28:713. Gn.W. 16:27; 21:667.—One of the most beautiful and graceful of all lilies, hardy, robust, permanent and highly recommended for both pots and open ground.

SUBGENUS IV. PSEUDO-MARTAGON.

A. Perianth widely expanded, pendulous. 42. *canadense*
AA. Perianth narrow.

B. Fls. pendulous or nearly so.

C. Color of fls. reddish purple. 43. *Bolanderi*

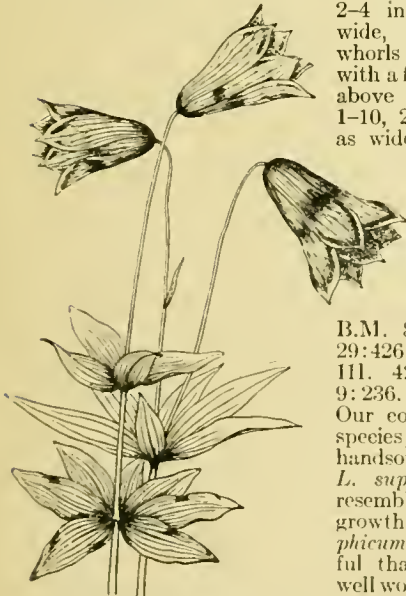
CC. Color of fls. orange-red.

D. Californian species. 44. *maritimum*

DD. Eastern species. 45. *Grayi*

BB. Fls. horizontal or nearly erect. 46. *parvum*

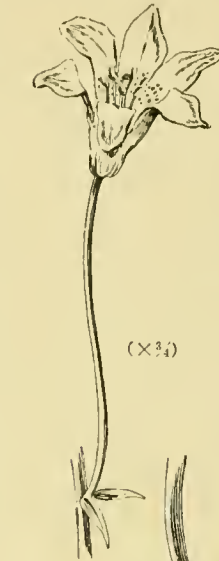
42. *canadense*, Linn. (*L. penduliflorum*, DC. *L. pendulum*, Spæth). MEADOW LILY. WILD YELLOW LILY. Fig. 2169. Bulb rhizomatous, similar to that of *L. superbum*, but usually smaller: st. 2-5 ft. high, smooth, slender, bare of lvs. for 6-8 in. above the surface: lvs. horizontal, 2-4 in. long, $\frac{1}{3}$ - $\frac{3}{4}$ in. wide, usually in 4-8 whorls of 4-10 lvs. each, with a few scattered ones above and below: fls. 1-10, 2-3 in. long and as wide, bright orange-yellow spotted purplish brown; anthers red. Late June to early Aug. New



2170. *Lilium Grayi*. Flowers usually more pendulous. ($\times \frac{1}{2}$)

Brun. to Ont., Minn., Mo., Ga. and Ala. El. 27. B.M. 858 (poor). Gn. 29:426; 34, p. 182. J.H. III. 42:131. Gn. M. 9:236. A.G. S:249.—Our commonest native species; although not so handsome or showy as *L. superbum* which it resembles in habit of growth, or *L. philadelphicum*, it is more graceful than either and is well worthy of cult. Var. *flavum*, Kunth (var. *luteum*, Hort.), produces

lemon-yellow fls. spotted purplish brown. B.M. 800. Var. *coccineum*, Kunth (var. *rubrum*, Hort.), produces larger fls. of a bright orange-red, spotted purplish brown and heavily tinged deeper red on the outside.



2171. *Lilium parvum*. Bulbs usually more clustered.

fls. frequently solitary, sometimes 2-6 together, $1\frac{1}{2}$ -2 in. long, nearly as wide, orange-yellow inside, tipped and tinged dull red and thickly spotted deep purplish brown, outside deep reddish brown; anthers red. Late June, July. Va. and N.C. B.M. 7234, F.S.R. 1:262. G. 29:475. G.C. III. 30:69. G.M. 49:142. G.F. 1:19 (adapted in Fig. 2170).—Not a showy species, but very graceful and of easy cult. Excellent for both pots and open ground.

46. *parvum*, Kellogg. Fig. 2171. Bulb a scaly rhizome, 2-3 in. long, covered with small, thick, white scales, often jointed 1-3 times: st. 2-5 ft. high, slender, smooth: lvs. horizontal, 1-3 in. long, $\frac{1}{4}$ - $\frac{3}{4}$ in. wide, the upper and lower ones scattered with a few whorls between: fls. 1-15, $1\frac{1}{2}$ -2 in. long and as wide; ends of segms. bright orange-scarlet, while the base is bright yellow, spotted purplish brown; anthers red. June, early July. Sierra Nevada Mts. of Calif. El. 30. B.M. 6146. F.S. 21:2192. J.H. III. 31:113.—A graceful pretty species of easy cult., but not showy. Var. *luteum*, Hort., produces clear bright yellow fls. spotted purplish brown and with orange anthers.

SUBGENUS V. ISOLIRION.

A. Lvs. mostly whorled.

B. Japanese species. 47. *medeoloides*

BB. American species. 48. *philadelphicum*

AA. Lvs. scattered.

B. Style longer than ovary.

C. American species. 49. *Catesbaei*

CC. European species.

D. St. bulb-bearing. 50. *bulbiferum*

DD. St. not bulbiferous. 51. *croceum*

ccc. Asiatic species.

d. Early-flowering.

ee. St. not over 2 ft. high. 52. *elegans*

EE. St. 2 ft. or more high. 53. *dauricum*

DD. Late-flowering.

e. St. not over 2 ft. high. 54. *Wallacei*

EE. St. 2 ft. or more high. 55. *Batemanii*

nn. Style shorter than ovary or of the same length. 56. *concolor*

47. *medeoloides*, Gray (*L. maculatum*, Thunb.). WHEEL LILY. SPOTTED LILY. Bulb very similar to that of *L. avonacum*: st. 1-2 ft. high, smooth or slightly furrowed, lower part bare of lvs.: lvs. 4-6 in. long, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. wide, usually in 1-2 whorls of 7-14 lvs. each near middle of st. with a few scattered ones above: fls. 1-6, smooth inside, bright orange-red slightly dotted purple; anthers red. Late June, July. Korea and N. Japan.—Very rare, and recommended only for specialists.

48. *philadelphicum*, Linn. WILD RED LILY. WOOD LILY. Fig. 2173. Bulb globular or nearly so, 1-1 $\frac{1}{2}$ in. diam., white or pale yellow; scales small and thick, sometimes jointed: st. 1-3 ft. high, slender, smooth, lower part bare of lvs.: lvs. horizontal, 2-4 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide, usually in whorls of 3-8 lvs. each, with a few scattered ones above: fls. 1-5, 3-4 in. diam., smooth inside, bright orange-red tinged yellow in center and spotted deep purple; anthers red. Late June, July. Maine to Minn., Mo. and N. C., also Canada, as far west as Sask. El. 17. B. R. 594. L.B.C. 10: 976. B.M. 872 (as *L. pennsylvanicum*); 519. C. L. A. 17: 544.—Our most beautiful native

2172. *Lilium Hansonii*. No. 29. ($\times \frac{1}{3}$)

lily, but indifferent to cult., the best specimens usually being found in a wild state. Var. *andinum*, Nutt., the WESTERN RED LILY, is a stronger grower, with larger, more richly colored fls. and mostly scattered lvs. Ohio to Mont., Col. and Ark. Var. *wausharaicum*, Leicht., originally found in Waushara Co., Wis., is very similar, if not identical. So also are *L. lanceolatum*, Fitzp., *L. montanum*, Nelson, and *L. umbellatum*, Pursh.

49. *Catésbaei*, Walt. SOUTHERN RED LILY. Bulb oblong, 1-2 in. long, $\frac{3}{4}$ -1 in. wide, composed of a few long, narrow, white scales: st. 1-2 ft. high, slender, smooth: lvs. semi-erect or nearly horizontal, 1-3 in. long, $\frac{1}{2}$ - $\frac{1}{2}$ in. wide: fls. 1-3, 3-4 in. diam., smooth inside, of the same color as those of *L. philadelphicum*; anthers red. Late June, July. N. C. to Fla. and Ala. El. 25. B.M. 259. L.B.C. 9: 507. R.H. 1868: 431 (poor).—Rather tender and capricious, and in the North best grown in pots.

50. *bulbiferum*, Linn. Bulb globular or slightly spherical, 2-4 in. diam., white or pale yellow, often tinged red or purple: st. 2-4 ft. high, furrowed, green, tinged and spotted purplish brown, upper part covered with white down and producing bulbils in the lf.-axils: lvs. 50-75, horizontal or semi-erect, 3-4 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide: fls. 1-4, 3-4 in. diam., bright orange-red spot-

ted deep purplish black and tinged or blotched yellow in center; anthers red. June, early July. Cent. Eu. and S. E. Scandinavia. El. 23. B.M. 36.—A hardy, long-lived species of the easiest cult., but not often seen. Var. *latifolium*, Hort., is a larger, stronger grower with wider lvs. Var. *humile*, Hort., is of smaller growth, with narrower lvs.

51. *crôceum*, Chaix (*L. aureum*, Parkin. *L. aurantiflucum*, Hort.). Bulb similar to that of *L. bulbiferum*: st. stout, 3-6 ft. high, furrowed or striated, deep green, lower part spotted deep purple, upper part and buds covered with white down: lvs. 50-100, horizontal or semi-erect, 2-4 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide: fls. 1-20, 3-4 in. diam., bright orange-yellow spotted purplish black in center and sometimes tinged red; anthers red. Late June, July. Alps Mts. of Switzerland, France and N. Italy. L.B.C. 8: 784 (poor). Gn. 71, p. 43.—A handsome, showy lily, hardy, vigorous, long-lived, of the easiest cult. and highly recommended. Var. *Châixii*, Hort., is of much smaller growth, only 1-1 $\frac{1}{2}$ ft. high, with 1-3 fls. and comes into bloom earlier. El. 22.

52. *elegans*, Thunb.

(*L. lancifolium*, Thunb. *L. Thunbergianum*, Roetz. & Schult.). Fig. 2174.

Bulb spherical or nearly globular, 1-2 in. diam., white or pale yellow, often tinged red or purple: st. 1-1 $\frac{1}{2}$ ft. high, smooth or slightly furrowed, green, upper part slightly pubescent: lvs. 20-40, horizontal or semi-erect, 2-4 in. long, $\frac{1}{4}$ - $\frac{1}{2}$ in. wide: fls. 1-4, 4-6 in. diam., orange-red, slightly spotted purplish black; anthers red. June, early July. Japan. El. 19, 20. Gn. 38: 440; 47, p. 415; 62, p. 359; 67, p. 204. F. 1868: 121. F.S. 16: 1627. I.H. 12: 459 (as *L. formosum*). G.W. 3, p. 355. H.U. 4, p. 201.—There are innumerable varieties and the origin of some of them is difficult to trace, but they probably have some blood of related species, such as *L. croceum*, *L. bulbiferum* and *L. dauricum*, in their make-up. Var. *alutaceum*, Baker & Dyer (var. *aureum nigro-maculatum*, Hort.; var. *Kikak*, Hort.), grows only 6-9 in. high, blooms earlier and produces solitary, pale apricot-colored fls. spotted purple-black. F.S. 22: 2319. A form of this, var. *grandiflorum*, is a larger, stronger grower. Var. *armeniaceum*, Baker & Dyer (var. *venustum*, Kunth), blooms later than the type, producing 1-2 bright orange-scarlet, unspotted fls., smooth inside: the lvs. are peculiarly twisted. Var. *atrosanguineum*, Baker & Dyer (var. *coruscans*, Hort.), produces solitary deep blood-red fls., spotted purple-black. Var. *Alice Wilson*, Hort., produces pure lemon-yellow spotted fls. Var. *aurantiacum*, Hort., produces unspotted salmon fls. P.M. 6: 127. Var. *bicolor*, Hort. (var. *pictum*, Hort.), has narrower lvs. than those of the type and broader perianth-segments: fls. 2-4, yellow,



2173. *Lilium philadelphicum*. ($\times \frac{1}{3}$)

edged and tipped bright red, spotted purple-black. Var. *brevifolium*, Baker & Dyer, has shorter lvs. than the type and blooms earlier, producing solitary fls. of a pale orange-red, spotted purple-black and flaked yellow at base of segms. Var. *citrinum*, Wilson, is a stronger grower than the type, 2-2½ ft. high, and blooms later, producing 2 or 3 unspotted citron-yellow fls. Var. *fulgens*, Morr., has narrower lvs. than the type and produces 4-6 deep orange-red fls., very slightly, or not at all, spotted. A semi-double form of this, of little value, is known as var. *semi-plenum*, Hort. (var. *slaminosum*, Hort.). G.M. 46:597. Var. *alternans*, Sieb., is similar to var. *fulgens*, but the fls. are suffused or flaked yellow. Var. *hæmatochroum*, Lem. (var. *Hörsmannii*, Hort.), produces deep blood-red fls. thickly spotted purple-black. Var. *Māwi*, Hort., produces orange fls. flaked crimson and spotted purple-black. Var. *marmoratum*, Hort., blooms earlier than the type, producing 2-4 rich crimson fls. flaked and tipped orange-yellow and slightly spotted. Var. *marmoratum albreum*, Hort. (var. *robustum*, Hort.), produces orange-yellow fls., edged, flaked and tipped crimson and more thickly spotted. A.F. 35:105. Var. *Orange Queen*, Hort., produces 1-3 bright orange fls. which are larger and with broader segms. than those of the type. Var. *Prince of Orange*, Hort., is dwarfier than the type, blooms earlier and produces soft buff fls., spotted purple-black. Var. *sanguineum*, Lindl., also blooms earlier, producing 1-2 blood-red fls. slightly tinged orange and spotted purple-black. Var. *biligulatum*, Hort. (var. *lateritium*, Hort.), is similar, but with deeper chestnut-red, spotted fls. Var. *splendens*, Hort., is a larger, stronger grower than the type, often 2½ ft. high, with broader, paler lvs. and blooms earlier producing rich apricot-yellow, spotted fls. Var. *Van Houttei*, Hort., produces deep crimson-scarlet fls. with a yellow blotch near the center of each segm. Var. *Wilsonii*, Hort. (var. *pardinum*, Morr.), is a stronger grower than the type, 2-3 ft. high, with shorter, curved lvs. and blooms later, producing apricot-colored fls., spotted deep purple and with a yellow band through the center of each segm.—All the above varieties, as well as the type, are of the easiest cult. in almost any soil or location and are highly recommended for general planting. They are excellent for rock-gardens, pots or naturalizing.



2174. *Lilium elegans*.
(×¼). No. 52

53. *dauricum*, Ker-Gawl. (*L. spectabile*, Fisch. & Mey. *L. umbellatum*, Hort.). CANDLESTICK LILY. Bulb similar to that of *L. elegans* but usually larger: st. 2-3 ft. high, smooth or slightly furrowed, green, sometimes tinged purple or brown; upper part slightly pubescent: lvs. 20-50, horizontal or nearly so, 3-5 in. long, ¼-½ in. wide: fls. 1-5, 3-5 in. diam., orange-red slightly spotted purplish black and tinged yellow in center; anthers red. June, early July. S. E. Siberia.—Of the same easy cult. as *L. elegans*, succeeding almost anywhere. Var. *atrosanguineum*, Hort., is of stronger growth with deeper blood-red fls. tinged or blotched yellow in the center and spotted purple-black. Vars. *incomparabile*, Hort., *grandiflorum*, Hort., *multiflorum*, Hort., are all similar, if not identical. Var. *Diadem*, Hort., produces bright crimson fls. with a yellow band through each segm. Var. *erectum*, Hort., produces yellow fls. tipped orange-red, slightly, or not at all spotted. Var. *bicolor*, Hort., is similar. Var. *luteum*,

Hort., produces bright yellow fls. thickly spotted. G. 36:431. Gn. 79, p. 39. G.C. III. 51, suppl. June 1. Var. *punctatum*, Hort. (var. *ribens*, Hort.), produces orange-yellow, spotted fls. Var. *immaculatum*, Hort. (var. *Vulcan*, Hort.), is similar but the fls. are unspotted. Var. *Sappho*, Hort., is a dwarfier grower than the type, with orange-yellow fls. tipped and splashed red and spotted purple-black. The following four varieties appear to be related to *L. croceum* and *L. elegans*, as they resemble them in certain respects. Var. *aurantiacum*, Hort., with orange-yellow fls.; var. *Cloth of Gold*, Hort., also with bright orange-yellow fls.; var. *Sensation*, Hort., orange-red fls.; and var. *Tottenhamii*, Hort., with bright pure yellow fls.

54. *Wallacei*, Wallace (*L. elegans* var. *Wallacei*, Hort.). Bulb caespitose, globular or nearly so, 1-1½ in. diam., composed of a few broad, white scales, often tinged pink or purple: st. 1-2 ft. high, smooth, green, tinged purplish brown: lvs. 50-75, horizontal or semi-erect, 1½-3 in. long, ¼-½ in. wide: fls. 1-10, 4-5 in. diam., smooth inside, pale orange-red or apricot, spotted purplish black; anthers red; segms. only slightly, or not at all, clawed at the base. Late July, Aug. Japan.

Gn. W. 21:739.—Thought by some authorities to be a hybrid between *L. tigrinum* or *L. Maximowiczii* and *L. concolor*. Easily grown and deserving of more general cult., both for pots and open ground.

55. *Bätemanniae*, Wallace (*L. elegans* var. *Bätemannia*, Hort.). Bulb, quite similar to that of *L. tigrinum*: st. 2-4 ft. high, smooth, green, lower part shaded brown: lvs. 100 or more, horizontal, 2-5 in. long, ¼-¾ in. wide, upper ones slightly recurved: fls. 1-12, 3-5 in. diam., pale orange-red or apricot, sometimes tinged pink, unspotted; anthers red; segms. smooth or nearly so inside, only slightly, or not at all, clawed at the base. Late July, Aug. Japan. G. 28:455.—Perhaps a hybrid between *L. Leichtlinii*, or *L. Maximowiczii* and some variety of *L. elegans*. It is strong, hardy, easily grown and highly recommended for general cult.

56. *concolor*, Salisb. STAR LILY. Bulb caespitose, similar to that of *L. Wallacei*: st. 1-1½ ft. high, green, tinged purple, slightly pubescent: lvs. 20-30, erect or semi-horizontal, 1½-3 in. long, ½-¾ in. wide: fls. 1-4, 2-3 in. diam., bright crimson-scarlet, slightly, or not at all, dotted purple-black; anthers red. Late June, July. Japan. El. 18. B.M. 1165. F.W. 1873: 289.—A graceful, handsome lily of easy cult., excellent for both pots and open ground. Var. *Parthenëion*, Sieb. & De Vr., is very similar, if not identical. Var. *Coridion*, Sieb. & De Vr., produces slightly larger fls. of a rich yellow, flaked brown.—*L. pulchellum*, Fisch. & Mey. (*L. Buschianum*, Lodd.), is allied to *L. concolor*, but differs from it in the bulb being solitary and more oval, the lvs. slightly wider and of a deeper green, the fls. appearing earlier, slightly smaller and more thickly spotted. S. E. Siberia and Manchuria. Var. *luteum*, Hort., from Mongolia, produces rich yellow, spotted fls.—*L. sinicum*, Lindl., resembles *L. pulchellum*, but grows 2-3 ft. high and produces 4-6 larger fls. China and S. Siberia. B.M. 6005. L.B.C. 17:1628 (as *L. Buschianum*).

SUBGENUS VI. CARDIOCRINUM.

- A. Fls. horizontal or slightly pendulous... 57. *giganteum*
AA. Fls. erect or nearly so..... 58. *cordifolium*

57. *giganteum*, Wall. Bulb oval, 6-8 in. long, 4-6 in. wide, deep green tinged brown; scales few, very broad and thick, closely clasped together and blunt at the ends: st. 4-12 ft. high, stout, smooth, 1½-3 in. diam. at base: lvs. 12-20, scattered, deep green, lower ones horizontal or nearly so, 12-18 in. long, nearly as

wide, upper ones smaller and more erect: fls. in racemes of 6-12, 5-6 in. long, nearly as wide, deliciously fragrant, with waxy segms., which, when first opening, are citron-yellow inside, soon changing to pure white tinged purple near the base and with purple midribs, outside often shaded green; anthers yellow. July, early Aug. Himalaya Mts. from Kumaon and Gurwhal to Khasia and Sikkim. El. 2. B.M. 4673. F. 1874, p. 79. R.H. 1861, p. 310. J.H. p. 11. G.C. III. 8:47; 16:754; 30:51; 38:296. Gn. 8:504; 34, p. 269; 52, p. 226; 60, p. 47; 69, p. 199; 71, p. 439; 74, p. 142; 77, p. 35. J.H. III. 46:336; 53:347; 65:113. G.M. 48:787. G.W. 5, p. 67; 7, p. 412. J.F. 4:409-11. A.F. 22:5. G.F. 6:376.—A beautiful, stately lily, rarely cult. in this country, but hardy as far north as Boston, and easily grown in light, well-drained soil; should be heavily mulched during the winter; also excellent for greenhouse benches or large tubs. After once flowering, the old bulb decays and disappears, leaving several offsets. Var. *yunnanense*, Hort., from China, is said to produce larger, better-colored fls.

58. *cordifolium*, Thunb. Bulb similar to that of *L. giganteum*, but smaller: st. 3-4 ft. high, stout, smooth, bare of lvs. for a foot or more above the surface, then a whorl of 6-8 lvs. appears, with a few scattered ones above; they are pendulous, 12-18 in. long, nearly as wide, deep green, lower ones tinged deep red: fls. in racemes of 4-10, 4-6 in. long, nearly as wide, fragrant, of the same color as those of *L. giganteum*. July, early Aug. Japan and the Kurile Is. El. 1. G.C. III. 8:41. B.M. 6337.—Very rare and not so easily grown as *L. giganteum*, to which it is inferior in every respect; only suitable for collectors or specialists.

SUBGENUS VII. NOTHOLIRION.

59. *roseeum*, Wall. (*L. Thomsonianum*, Lindl. *Fritillaria Thomsoniana*, Royle). A peculiar plant, suggesting *Hosta*, *Anthericum*, *Ornithogalum*, and similar things: st. erect, about 1½ ft.: lvs. like a *Hemerocallis*, linear-acuminate and grassy, mostly crowded at the base of the st.: fls. as many as two dozen, pale mauve, about 1½ in. long, and nearly as broad at the mouth, bell-shaped, the 6 segms. free to the base; anthers deep purple, oblong; stigma 3-lobed. W. China to N. India (Himalaya). B.M. 4725. B.R. 31:1. J.H. III. 64:279. Gn. 76, p. 158; 67, p. 302 (var. *multiflorum*, Leicht.).—Little cult. abroad; may be desirable in milder parts of this country.

L. albancum, Griseb. Very similar to *L. Jankæ*. Albania.—*L. Alexandri*, Baker (*L. japonicum* var. *Alexandri*, Hort.). St. 2-3 ft. high: lvs. scattered, 5-6 in. long, ½-¾ in. wide: fls. trumpet-shaped, usually solitary, semi-erect, 5-6 in. long, nearly as wide, delicately fragrant, with waxy, pure white segms., shaded green at the base. Late June, July. Liu Kiu Is. Possibly a hybrid between *L. auratum* and *L. longiflorum*.—*L. Bakeri*, Purdy (*L. Purdyi*, Waugh). Bulb similar to that of *L. columbianum*: st. 2-5 ft. high: lvs. mostly verticillate: fls. 1-10, horizontal or semi-pendulous, slightly fragrant, with reflexed orange-red segms. spotted deep purple. Wash. and Brit. Col.—*L. Bakerianum*=*L. Lowi*.—*L. Bérénisii*, Hort. A garden hybrid between *L. testaceum* and *L. chalcidionum*: st. 3-4 ft. high: fls. fragrant, similar to those of *L. testaceum* in size and shape, but brighter, and richer in color. Aug., early Sept.—*L. Biōndii*, Hort. Resembles *L. Maximowiczii*: st. 3-4 ft. high: lvs. scattered, linear: fls. several, pendulous, 2½ in. across, with reflexed segms., orange-red spotted deep purple-black with reddish brown anthers. G.M. 57:493.—*L. claptōense*, Hort.=*L. primulinum*.—*L. Davidii*, Duch. Allied to *L. concolor*: st. 2-3 ft. high, with narrow, scattered lvs.; fls. erect, solitary, star-shaped, orange, spotted purple. Tibet. El. 24.—*L. De-laigii*, Franch. Fls. rose crimson; belongs in subgenus *Archelirion*. China.—*L. Döer*, Hort. A garden hybrid, resembling *L. longiflorum*. J.H. III. 51:27, desc.—*L. Duchâtetii*, Franch. St. about 3 ft. high, smooth: lvs. lanceolate, acuminate, 2½ in. long, ½ in. wide: fls. 1-7, pendulous, 3 in. diam., white, tinged rose outside, finely spotted inside. W. and S.W. China. B.M. 8072.—*L. Fargesii*, Franch. A Martagon with small yellow fls. China.—*L. Fargesii*, Hort.=*L. Sargentii*. F. E. 33:492.—*L. formosum*, Franch. Fls. erect, white, similar to those of *L. elegans*. China.—*L. Gléhnii*, F. Schmidt. Differs only slightly from *L. cordifolium*. Japan.—*L. Hübnerii*, Baker. Intermediate between *L. carnolicum* and *L. chalcidionum*: st. 2-3 ft. high, with narrow, scattered lvs. and 1-4 bright orange-red fls. tinged yellow outside. Late June, July. Greece.—*L. kewense*, Hort. A garden hybrid between *L. Henryi* and *L. Brownii* var. *Chloraster*; resembles a small *L. auratum* in habit of growth and form of fls., but the

lvs. are similar to those of *L. Henryi*; fls. rich cream-color, fading to nearly white and with a deep creamy-yellow band through the center of each segm. July, Aug. G.C. III. 29:116. Gn. 58, p. 99.—*L. lankongense*, Franch. Fls. purple, spotted black. Belongs in subgenus Martagon. Yunnan, China.—*L. lophophorum*, Franch. A Martagon about 1 ft. high, with canary-yellow fls. Western China.—*L. Löwi*, Baker (*L. Bakerianum*, Coll. & Hemsl.). St. 2-3 ft. high: lvs. scattered, narrow, erect: fls. 1-3, pendulous, bell-shaped, 3-4 in. long, nearly as wide, with slightly recurved ivory-white segms. spotted or blotched purple near the base inside and tinged green outside. Yunnan and N. Burma. J. H. III. 43:55. G. 27:645. G.C. III. 14:121; 30:45; 38:75. Gn. 45:278. B. M. 7232.—*L. Maseyi*, Hyams. A southern form of *L. philadelphicum*, differing but slightly. N. C.—*L. Miquelinianum*, Makino. Said to be an improved form of *L. medeoloides*. Japan.—*L. mirabile*, Franch. Similar to *L. cordifolium*. China.—*L. occidentale*, Purdy. Resembles *L. maritimum*, but the segms. of the fls. are more reflexed: bulb rhizomatous: st. 2-4 ft. high: lvs. usually verticillate, lower ones sometimes scattered: fls. 1-15, orange-yellow, tipped red, spotted purple. Calif.—*L. ochroleucum*, Franch. A yellow-flowered Martagon resembling *L. monadelphum*, China.—*L. oxyptalum*, Baker. 1-1½ ft. tall: lvs. 20-30, scattered, lanceolate-linear: fl. wide funnel-shaped or nearly rotate, purplish, tinged with green beneath, somewhat dotted inside. W. Himalayas. El. 5.—*L. papilliferum*, Franch. A dwarf *L. Maximowiczii*, with orange-red fls. China.—*L. Parkmannii*, T. Moore. A hybrid between *L. auratum* and *L. speciosum*: st. slender, 2-4 ft. high: lvs. scattered, alternate: fls. 8-12 in. diam. of the same shape as those of *L. auratum*, but colored like those of *L. speciosum*. G.C. III. 30:52.—*L. ponticum*, Koch. Resembles *L. monadelphum*, but is smaller, seldom over 2 ft. high. Asia Minor.—*L. primulinum*, Baker (*L. claptōense*, Hort.). Fls. pure primrose-yellow, trumpet-shaped, intermediate in form between those of *L. neilgherrense* and *L. nepalense*. N. Burma. B.M. 7227.—*L. Purdyi*=*L. Bakeri*.—*L. Rösthernii*, Diels. Belongs in subgenus Martagon. China.—*L. taliense*, Franch. A tall-growing Martagon with white fls. China.—*L. Thayera*, Wilson. Bulb 2-2½ in. diam., ivory-white: st. 4-4½ ft. high, clothed with long, linear lvs. and usually bearing 16 or 17 fls. W. China. G.C. III. 54:116. Intro. as *L.utchuense*.—*L. tubiflorum*, Wight. Closely resembles *L. neilgherrense*, except the lvs. and perianth-segms. are narrower. Himalaya Mts.—*L. Warreri*, Purdy. Said to be intermediate in character between *L. pardalinum* and *L. Parryi*: fls. fragrant, bright yellow, spotted deep purple. Calif.—*L. Willmotii*, Wilson (*L. warleyense*, Hort.). St. about 4 ft. high: lvs. numerous, spirally arranged, linear, 3-5 in. long: fls. 20 or more, pendulous, 3 in. diam., recurved, orange-red, spotted reddish brown. China. G.M. 55:513.—*L. Yōshidaii*, Leicht. Fls. fragrant, resembling those of *L. Brownii*. Philippine Is. Gn. 68, p. 238.—*L. yunnanense*, Franch. St. 1-3 ft. high: fls. 1-3, small, pendulous, pink or nearly white. Yunnan, China.

JOHN H. TILTON.

LILY, in the narrowest sense, is restricted to the genus *Lilium*, but the popular names given below also include plants outside the family Liliaceæ. Many of them belong to the Amaryllis family. African Blue L., *Agapanthus umbellatus*. African Corn L., *Ixia*. Amazon L., *Eucharis grandiflora*. American Turk's-Cap L., *Lilium superbum*. Atamasco L., *Zephyranthes Atamasco*. Barbados L., *Hiippeastrum equestre*. Belladonna L., *Amaryllis Belladonna*. Bengal L., *Criminum*. Bermuda L., *Lilium Harrisii*. Black L., *Fritillaria camtschaticensis*. Blackberry L., *Belameanda chinensis*. Bourbon L., *Lilium candidum*. Brisbane L., *Euryclis sylvestris*. Calla L., *Zantedeschia æthiopica*. Cape L., *Criminum longifolium*. Checkered L., *Fritillaria meleagris*. Climbing L., *Gloriosa* and *Lilium*. Common White L., *Lilium candidum*. Day L., the blue and white ones are *Hostas*; the yellow and orange ones *Hemerocallis*. Easter L., *Lilium Harrisii*. Fairy L., *Zephyranthes rosea*. Fayal L., *Ornithogalum arabicum*. Golden-banded L., *Lilium auratum*. Golden-rayed L., *Lilium auratum*. Guernsey L., *Nerine sarniensis*. Jacobean L., *Sprekelia formosissima*. Kaffir L., *Schizostylis coccinea*. Mariposa L., *Calochortus*. Martagon L., *Lilium Martagon*. Orange L., *Lilium croceum*. Peruvian Swamp L., *Zephyranthes candida*. Plantain L., *Hosta*. Pond L., *Nuphar advena*. Sacred L. of China, *Narcissus Tazetta* var. *orientalis*. Spider L., St. Bernard's L., *Anthericum Liliago*. St. Bruno's L., *Paradisa Liliastrium*. St. James' L., *Sprekelia formosissima*. St. Joseph's L., *Lilium candidum*. Swamp L., *Lilium superbum*. Sword L., *Gladiolus* in general. Tiger L., *Lilium tigrinum*. Turban L., *Lilium pomponium*. Turk's-Cap L., *Lilium Martagon*. Valley, L. of, *Lily-of-the-valley*, p. 1879. Water L., *Nymphaea*. White L., *Lilium candidum*.

LILY-OF-THE-INCAS. *Alstrameria Pelegrina*. See, also, *Hymenocallis* (Ismene).

LILY-OF-THE-PALACE. *Hiippeastrum auticum*.

LILY-OF-THE-VALLEY (*Convallaria majalis*, which see) is forced in large quantities in the United States all the year round. It is native in Europe, where it grows wild in the woods. It is grown and cultivated in large quantities in Germany for the export trade and is shipped to every country, millions reaching the United States every season.

The growing of lily-of-the-valley roots for the trade is an important branch and is done in Germany by experts. No effort and pains are spared to develop the pips and to produce superior stock. They are planted out in the open in the fall after the fields have been well prepared, deeply plowed and heavily manured. Every fall a certain field is planted and another taken up. The average "valley" is grown three years in the open field; but the best product is derived from a two-year crop. The man who assorts his planting stock carefully and does his growing better, raises the finest "valley" in two years and gets the highest prices.

Lily-of-the-valley propagates itself through runners or suckers. In taking up a field in the fall, the pips are assorted. The best ones are used for shipping, the seconds and culls for home consumption and are forced during the winter season. The runners are carefully sorted out and are used for planting stock the next year. They are planted in furrows about 1 foot apart, covered with about 2 inches of soil. Later in the season they should receive a top-dressing of rotted horse- and cow-manure. However, when the soil is heavy, a top-dressing of clean river sand should be applied. The soil of the northern part of Germany is so fertile that an application of sand acts as an amendment. These top-dressings are repeated every winter.

During the summer, the fields should be kept free from weeds by hoeing and cultivating. In dry seasons motor watering-wagons are used for sprinkling. The utmost care should be given during the planting season to protect the roots and keep them fresh and free from mold. The many complaints in this country about poor forcing results are usually traced to careless handling at the time when the "valley" is harvested and the stock is spoiled in storage. Good "valley" pips should be strong and have plenty of fine fibrous roots. This is very essential for forcing purposes, as the "valley" does not root in the forcing-bed. If the roots are spoiled or affected through mold, the plants become worthless. The successful growing of lilies-of-the-valley in the open field requires large acreage. Different crops should be grown for three or four years before lilies-of-the-valley are again planted in the same field. It can not be grown successively on the same ground, as the stock deteriorates and becomes practically worthless.

The forcing of lilies-of-the-valley is done mostly by specialists in this country, where a steady supply is kept up every day in the year for the cut-flower trade. The importing is done in the fall, and on arrival in this country the pips are placed in cold storage. They keep best in a temperature of 28°. After resting two or three months, they are taken out as desired. Cold storage lilies-of-the-valley are much more satisfactory and should be grown at all times. They do not require any special management nor strong forcing, and do best at a temperature of 65°. It hardly pays a florist to force lilies-of-the-valley in small quantities unless it is for home trade for the holidays, for basket-work and in pots. The commercial success depends on many things, and much money has been lost in this country on lilies-of-the-valley. A successful grower must know where his stock comes from and when to grow the different kinds as grown abroad. For early forcing it is best to have "valley" grown on light soil, which forces easier; for late forcing and cold-storage purposes, "valley" grown on heavier soil is to be preferred.

The specialist devotes separate houses to the forcing

of lilies-of-the valley, where he is able to give the right atmosphere and ideal conditions for successful growing. Plant right in the benches, which are about 3½ feet wide. Fill benches about 5 inches deep with clean sand, not too fine. After planting, keep them well watered all the time. For the first ten to fourteen days keep them dark. For this purpose, the benches are boxed in and covered with boards or cloths. Give light gradually after the stalks are well up, and finally remove the shade entirely in order properly to develop the flowers, give them more substance, and color to the foliage. It requires about three weeks properly to force lilies-of-the-valley in a temperature of 68°. New "valley" requires a good bottom heat of about 70° to 75°. Cold storage "valley" does not need any bottom heat. After cutting, the flowers are placed in the cooler over night and put up in bunches of twenty-five for the market. They are mostly used for wedding and corsage bouquets, and also for baskets and table-decoration.

Lilies-of-the-valley are hardy and are easily grown in the garden. They require no special attention. They are adapted for planting around shrubbery, porches or shady places, where they come up every season and bring an abundance of beautiful flowers.

H. N. BRUNS.

LIMATODES (perhaps from the Greek for *meadow*, referring to the habitat of the plants). *Orchidaceæ*. Similar to *Calanthe*, but the spurred labellum is not adnate to the column but closely wrapped around it. In *Phaius*, and in *Calanthe* also, the leaves are not articulated to the stem and therefore wither on the plant instead of falling.—One species in India.

After resting season of limatodes is over, say from February to May, shake off the old potting material. If plants are large, divide them and pot them moderately tight. For the American climate, chop finely some good turfy loam well mixed with old rotten cow-manure and a little leaf-mold and sharp sand and place in a shaded house, temperature 70° to 90°. Do not water till roots are well out, and sparingly till leaves are well started. After that and during flower-sheath growth, they will enjoy profuse waterings and spraying; water with weak liquid at intervals of ten days or so, and every plant will be a marvel of beauty. (Wm. Mathews.)

rosea, Lindl. (*Calanthe rosea*, Benth.). Pseudobulbs 4-8 in. long, pyriform or fusiform, grooved; lvs. 8-18 in. long, elliptic-lanceolate, acuminate, plicate; scape from the base of the pseudobulb, 12-18 in. long, slender, bearing a many-fl. villous raceme; fls. large, rosy, 1½ in. across; sepals ovate-lanceolate; petals oblong, acute; lip 1½ in. long, with a large obovate-oblong midlobe; base yellow, edged with scarlet. Jan. Burma. B.M. 5312.—A hybrid of this species and *Calanthe vestita*, Lindl., is common in cult. under the name *Calanthe Veitchii*, Lindl., which see. It has been said that *L. rosea* bore fls. as large as those of *Calanthe Veitchii*, and more brilliant in color. HEINRICH HASSELBRING.

LIME. The use of lime in agriculture antedates the Christian era. In modern times it has been an indispensable adjunct to potassic, phosphatic, and nitrogeous manures in restoring and maintaining the fertility of immense areas of soil derived from sandstone, granite, mica schist and certain shales and slates. Even limestone soils sometimes become so lacking in lime near the surface that they stand in great need of its application.

Without the use of lime, the wonderful transformation of Limousin in France, the sandy regions of Germany, and particularly the reclamation of the sour peat (Hoch-moor) soils of northern Germany would have been difficult or impossible. Its great value has also long been known in Scotland.

It is now recognized that lime is greatly lacking in

parts of New England, New York, New Jersey, Pennsylvania, Maryland, Ohio, Illinois, Wisconsin, and in many of the southern and western states.

The chief function of lime is to correct the chemical reaction of acid soils.

The necessity of lime as a direct plant-food for the higher orders of plants has been indisputably demonstrated and its physiological rôle is of the greatest significance.

Lime is of indirect service in various ways: (1) It aids in transforming the nitrogen of organic matter and ammonium salts into nitric acid, which, in combination with potash, soda, lime, and magnesia, furnishes most plants the major portion of their nitrogen. (2) It serves as an indirect food by transforming or setting free other soil ingredients which plants require. (3) It appears probable that liming favors symbiosis and the consequent assimilation of atmospheric nitrogen in the case of clovers, alfalfa and certain other legumes, while it may have an opposite effect upon others, among which may be mentioned serradella and certain lupines. (4) Lime attacks certain more or less inert combinations of potash and of phosphoric acid which exist in soils, thereby rendering their manurial constituents more readily assimilable. (5) Noxious iron compounds in soils are so acted upon by lime as to overcome their poisonous tendency. (6) The presence in soils of carbonate of lime and of silicates highly charged with lime prevents the formation of "sour" humus and toxic aluminum compounds, and hence injury to a large class of agricultural plants. (7) Liming makes clays more friable and sandy soils more compact, thus improving the texture of each. By the flocculation of the small particles of the former, water passes into them more readily and the danger of serious washing is thus diminished. (8) Soluble phosphates are less liable to be lost or changed into unassimilable forms in soils containing lime. (9) Lime lessens the danger of the destruction of nitrates, especially in soils which are in bad physical condition.

Large quantities of lime should not be employed on sandy soils in a single application, although there is less danger in using ground limestone than in the employment of either burned or slaked lime.

The repeated use of highly magnesian lime is fraught with possible danger, although if applied only occasionally in the place of ordinary lime the magnesia may sometimes prove highly beneficial.

The use of lime, whether in wood-ashes, burned lime, slaked lime, ground limestone, or combined with organic acids, increases the tendency to alkalinity of the soil, and hence makes it more favorable to the development of at least the common potato-scab, provided the fungus, which is the direct cause of the disease, is already in the soil or is introduced into it on the "seed" tubers.

The "root-rot" of tobacco, chlorosis of pineapples and the "dry spot" of oats may be promoted by excessive liming.

The disease which develops upon turnips and upon certain other plants, known as "club-foot," or "club-root" and "finger-and-toe," is lessened to a marked degree by large applications of lime. For this purpose burned and slaked lime are the most efficient forms to apply.

Slaked lime is usually applied to land, for ordinary purposes, at rates ranging from half a ton to two and a half tons to the acre, and at intervals of four to six years. Slaked lime usually contains 65 to 70 per cent of lime and magnesia; burned lime before slaking contains 90 to 95 per cent of lime and magnesia, whereas ground limestone and high grade marl contain from 48 to 52 per cent. The quantities of each of these forms to employ should be varied in accordance with their analysis, bearing in mind, however, that it is usually safer on light soils to make the applications of burned

and slaked lime relatively smaller than those of ground limestone and marl. On all light, sandy, and gravelly loams which are likely to become dry, ground limestone or marl should always be used if possible, but for flocculating heavy clay soils, burned or slaked lime is usually more quickly effective.

Lime should be thoroughly worked into the surface soil after plowing. Slaked lime can be applied with much greater safety on sandy soils if it is first composted with vegetable matter. Its beneficial effects in connection with composting have long been known. If lime is mixed with layers of loam, weeds, muck, coarse stable manure and other vegetable and animal matter, it forms in a few months, if kept moist, an excellent material for the use of gardeners. If worked over a few times, at intervals, the fermentation is materially hastened. The introduction of a little common salt or of muriate of potash facilitates the process by virtue of the formation of carbonate of soda or carbonate of potash. In order to prevent the loss of ammonia, compost heaps should be kept covered with a layer of moist earth.

The influence of lime on plant growth is often astounding. Lettuce, spinach, beets, onions, muskmelons, asparagus, clovers, timothy, Kentucky bluegrass and certain poppies are almost failures on very



2175. Acid lime.—*Citrus aurantifolia*. ($\times \frac{1}{2}$)

acid soils until lime is applied. Watermelons, lupines, serradella, cranberries, rhododendrons, azaleas and other plants might be cited, some of which are known to be indifferent, injured, or even ruined by heavy applications of lime. Their natural home is on a sour soil. The Early Richmond and Black Tartarian cherries are both helped by liming. The Delaware grape seems to be helped by liming in a greater degree than the Concord. The Blackcap raspberry does not respond to liming on a very acid soil whereas the Cuthbert, a red variety, responds favorably to the treatment. The quince is more in need of lime on an acid soil than the apple, pear, or peach. The American linden and American elm are helped by lime on acid soils whereas the white birch may show utter indifference to it. The success of the beech on the limestone soils of Europe indicates its natural home. Chestnut trees are said not to thrive well on limestone soils, and the heavy liming of certain spruces and pines is often injurious, although it is reported from France that the light liming of certain soils which were presumably exceedingly acid has sometimes been found helpful. Goose-

berries and currants are often helped by liming on soils where liming is detrimental, or of little or no aid, to the strawberry.

The state of Rhode Island owes its fame as the home of the Rhode Island bent to the fact that this grass can persist on very acid soils whereas many other grasses fail. On such soils there is but little likelihood that the common poppy will ever become a pernicious weed as it has in many of the wheat-fields of Europe. Such soils are, however, the natural home of the common sorrel. Among the cereals, Indian corn and rye are best adapted to acid soils, and these are followed in turn by oats, wheat, and barley.

The following table compiled from the results obtained at the Rhode Island Agricultural Experiment Station shows, numerically, some of the striking contrasts between different kinds of plants as concerns their response to liming.

Name of plant	Very acid soil		Moderately acid soil	
	Unlimed	Limed	Unlimed	Limed
<i>Flowering plants.</i>				
Galega officinalis, Goat's Rue.....Height, inches	10.0	39.0	22.0	50.0
Salvia splendens, Scarlet Sage.....Height, inches	6.0	6.0	6.0	6.0
Silene orientalis, Catchfly.....Height, inches	30.0	25.0	30.0	24.0
Lathyrus odoratus, Sweet Pea.....Number of blooms	780.0	3,433.0	2,777.0	3,591.0
<i>Trees.</i>				
Elm, American.....Average gain in diameter in four years	2.1	2.6	2.6	3.0
Peach, Early Crawford.....Average gain in diameter in four years	2.7	3.1	3.0	2.8
Plum, Burbank, Japanese.....Average gain in diameter in four years	1.1	1.6	1.6	1.9
Spruce, Norway.....Average gain in diameter in four years	1.5	1.1	1.7	1.4
<i>Small fruits.</i>				
Blackberry, Snyder.....Pounds of fruit	30.2	52.1	30.2	17.5
Currant, Prolific.....Pounds of fruit	1.3	5.2	2.5	8.5
Cranberry, American Bell.....Pounds of vines	1.7	0.3	1.5	0.3
Raspberry, Blackcap.....Pounds of fruit	5.1	3.2	7.0	2.9
Raspberry, Cuthbert.....Pounds of fruit	6.0	12.8	7.0	8.8
<i>Vegetables.</i>				
Asparagus.....Pounds	0.0	9.2	2.1	14.3
Beet, Eclipse Table.....Pounds	0.2	164.2	70.1	196.0
Lettuce, Butterhead.....Pounds	0.02	44.4	5.3	50.8
Cantaloupe, Netted Gem.....Pounds	0.0	88.8	30.8	116.0
Watermelon, Phinney.....Pounds	223.8	166.3	364.1	230.5
Onion, Large Red Wethersfield.....Pounds	0.3	41.5	24.0	44.3

It is of interest to note the poorer result with *Silene orientalis* where the soil was made more nearly neutral or alkaline, and the almost fatal effect of liming on the cranberry vines. This result should be compared with that with the sweet peas and beans. H. J. WHEELER.

LIME (Fruit). The acid lime (*Citrus aurantifolia*; see volume II, page 782), Fig. 2175, is found in most parts of the tropics, and is commonly cultivated or found growing in a semi-wild state in India, Ceylon, the Malay Archipelago, West Indies, tropical Mexico, and to a lesser extent on the Keys and in the warmer parts of Florida. The West Indian Islands, Montserrat and Dominica, are noted for their commercial production of lime fruit, lime juice and citrate of lime. In California, the lime is grown as a home fruit in some parts, but as it does not possess the hardness of the orange or lemon, it is of no commercial importance. The sweet lime (*C. limetta*) is perhaps a hybrid, worthless as a commercial fruit in America, though grown and used in other countries.

In the eastern United States, the limes so largely used at the soda fountains are secured mostly from the West Indies, packed in barrels and imported via New York, although part of the supply comes from the Florida Keys. The supply of the western states comes from Mexico, for the most part. These limes, the product of seedling trees, are variously referred to as Mexican, West Indian or Key limes. In tropical countries, where limes may be secured at all seasons of the year, they are used almost entirely in place of lemons, and each year it is becoming a more important fruit through-

out America. There is no doubt but that it will eventually occupy a much larger place in our markets.

The cultivation of the lime is confined to regions where frosts are practically unknown. In the dormant or winter season, the trees respond very readily to rising temperatures, new and very tender growth starts and if a drop in temperature sufficient to cause frost follows, as it so often does in many regions where its culture has been tried, the trees suffer severely. Attempts are being made to secure a hardy fruit by crossing with the kumquat (see *Limequat*).

Of the varieties in cultivation, Tahiti and Persian are much the same. The fruits are as large as ordinary lemons. These are somewhat harder than the smaller-fruited seedling Mexican limes. Palmetto and Everglade are two varieties of Mexican limes, originated, named and described by H. J. Webber, (Yearbook United States Department of Agriculture, pages 279-

281, plate XX, 1905). These have neither been introduced nor planted commercially. Their merits in a large way are therefore unknown. There is no question but that the careful selection, and propagation by budding, of Mexican limes would be well repaid. Thornless is a recently introduced variety from Dominica of the Mexican type. The absence of thorns is a desirable feature. Bearss and Imperial, of the same general type as Tahiti, are grown in California. In the colder citrous sections the true limes may be replaced by the calamondin (*Citrus mitis*), a very prolific citrus which produces a small acid fruit of excellent flavor, resembling a small tangerine in color, shape and rind. Rangpur is an acid fruit, the size of a small lemon, round or oblate, orange-red in color, with deep orange-colored flesh, high quality and excellent flavor. It is often referred to as a lime from which it is distinct. Bonavia refers it to the Suntura orange group of India. It is harder than the true limes, in fact it ranks with the sweet oranges in this respect and is worth planting where the true limes cannot be grown.

The Mexican lime, grown as seedlings, is not particular in its soil-requirements. It grows and seems to flourish on poor sandy soils, or on rocky soils. It will grow and bear fruit in considerable quantities even when neglected and left unfertilized and uncultivated. These limes are produced in Florida on the lower East Coast and on the Keys, where an association has been formed for handling the crop. In other parts of South Florida, Tahiti and Persian have been planted in groves, in considerable numbers, and the fruit thus far has sold at good prices for local consumption.

Limes may be grown as seedlings or they may be propagated by budding on sour orange or rough lemon seedlings.

In orchard plantings, the seedlings are set 12 to 15 feet apart each way and the budded trees about 20 feet. The cultivation, fertilizing and general care are the same as for other citrus fruits.

The fruit is gathered when full grown, but while still green, packed and shipped immediately. Carefully handled, they keep well, but do not usually stand up so long as processed or cured lemons. It is sometimes stated that the Tahiti lime is a poor keeper. This is often due to the attacks of fungous diseases which can be guarded against.

They are attacked by the ordinary citrus insects. Anthracnose or wither-tip is the most serious fungous pest. This destroys the smaller twigs and branches and produces hard wart-like spots on the Mexican lime fruit. It may be held in check by careful pruning out of dead and diseased wood and by spraying with bordeaux mixture.

H. HAROLD HUME.

LIMEQUAT (from lime and [kum] quat). Fig. 2176. Hybrids between the common lime (*Citrus aurantifolia*) and the oval or round kumquats (*Fortunella margarita*, *F. japonica*). This new and promising



2176. Fruiting branch, and fruit and seeds in cross-section, of an oval limequat. ($\times \frac{1}{2}$)

citrus fruit was originated by the writer in 1909 by crossing the common West Indian lime with the kumquat. While the lime is the tenderest of all commonly grown citrus fruits and is frequently frozen to the ground even in southern Florida, the kumquat, because of its remarkable winter dormancy, is one of the hardiest of the evergreen citrus fruit trees. The limequat possesses in large measure the cold-resistance of the kumquat and can be grown in regions too cold for the lime. The limequat also shows resistance to citrus canker, a destructive bacterial disease, caused by *Pseudomonas citri*. Limequats vary in size, some being no larger than a large kumquat, while others are the size of a lime. The skin is thin and has an agreeable aroma and flavor; the pulp is juicy and pleasantly acid. This hybrid, which fruited for the first time in 1912, is a vigorous grower and a heavy bearer. It is being tested in the South.

WALTER T. SWINGLE.

LIMNANTHEMUM: *Nymphoides*.

LIMNANTHES (Greek, *marsh flower*). *Limnanthaceæ*. A few species of American annuals growing near the water. Low, diffuse, rather fleshy: lvs. pinnately dissected: fls. white, yellow or rosy, solitary on axillary peduncles, regular, the parts in 4's-6's; sepals valvate in the bud; glands alternating with the petals; stamens usually 10: carpels distinct or nearly so, at first fleshy, at length hard and wrinkled, indehiscent, separating from the short axis; ovule solitary. By some authors this genus is kept in Geraniaceæ, but this and *Floerkea* are by others separated in a small family *Limnanthaceæ*. The two genera are sometimes combined, but *Floerkea* is 3-merous and *Limnanthes* is commonly 5-merous, and there are other differences.

Douglasii, R. Br. (*Flærkæ Douglasii*, Baill.). MEADOW FOAM. Spreading, branched and glabrous yellow-green low herb with handsome white-yellow fragrant fls. nearly 1 in. across, cult. as a garden annual: about 1 ft. high: lvs. pinnate; lfts. sharply lobed or parted; petals oblong-spatulate, notched at apex, more or less yellow, white toward the tip: fr. smooth or slightly corrugated. Calif., Ore. B.M. 3554. B.R. 1673. Gn. 72, p. 611. G. 4:3.—The fls. vary somewhat in color: usually the petals are white with yellow toward the base; sometimes roseate and yellow. *L. grandiflora* (fls. larger) and *L. sulphurea* are garden names. The plant is easy of cult.

L. H. B.

LIMNÔBIUM (*living in pools*, from the Greek). *Hydrocharitaceæ*. American aquatic herbs, one of which is in the trade.

Stemless plants, spreading by means of runners, the large lvs. floating; monœcious, the fls. arising from spathes borne on the rootstock, the pistillate single from a spathe and the staminate 2-4 from a spathe, all with 6 white segms. or petals, the inner ones being very narrow; stamens in a column, bearing anthers at unequal heights; ovary with several (6-9) locules and as many stigmas, ripening into a many-seeded berry. As defined by some writers, the genus comprises a single species, *L. Spongia*; others unite with it the diœcious *Hydromystria* (incl. *Trianea*), 2 or 3 species of Trop. Amer.

Spóngia, Rich. (*Hydrocharis Spóngia*, Bosc. *L. Bösci*, Rich.). AMERICAN FROGBIT or FROG'S-BIT (the European Frogbit is *Hydrocharis*). A neat floating plant, with purplish, hanging, hairy roots and long-stemmed, orbicular, cordate or ovate lvs. 1-2 in. long and purplish beneath. Lake Ontario to Fla. and Texas.—Good for the aquarium. According to William Tricker, its mottled foliage and silky rootlets are very attractive and make it valuable in small areas or tanks, but when grown out-of-doors in summer in tubs or pools, it is very vigorous and soon becomes crowded; the lvs. instead of floating, then appear in an erect state, the spongy condition of floating lvs. having disappeared; it is really a floating plant, prop. by division of runners, and should not be placed in shallow water, where it can readily root into the soil.

L. stoloniferum, Griseb. (*Hydromystria stolonifera*, Mey. *Trianea bogotensis*, Karst.), is more sturdy in habit, of a lighter color—especially in winter—does not make such long runners, and forms more compact and attractive rosettes of lvs. Mex. to Para. guay; Trinidad.

L. H. B.

LIMNÔCHARIS (from Greek, referring to marsh habitat). *Butomaceæ*. Water plants, suitable for aquaria and for plunging in pools in summer.

Perennial aquatic herbs, stoloniferous, with lanceolate or ovate, petiolate, emersed lvs.; fls. perfect; sepals 3, persistent; petals 3, thin, fugacious; stamens numerous, the outer ones sterile: carpels 15-20, verticillate, style none, stigma sessile and extrorse.—Two species are admitted by Buehner, (Engler's *Pflanzenreich*, hft. 16. 1903), both tropical American. From *Hydroc-*

leis it differs in its more numerous verticillate carpels, no style and different stigmas.

flava, Buchen. (*L. Plumière*, Rich. *L. emarginata*, Humb. & Bonpl. *Alisma flavum*, Linn.). Sts. erect, angled, 10-16 in. high in bloom; lvs. erect, standing out of the water, the blade from lanceolate to broad-ovate, cuneate or cordate at base; fls. in umbel-like clusters of 2-12, the peduncle 3-angled and toward the top 3-winged; sepals broadly ovate and obtuse, greenish; petals broadly ovate or orbicular, yellow; carpels 15-20, scarcely cohering. W. Indies and S. Amer. B.M. 2525.—*Limnocharis flava* is entirely distinct from *Hydrocleis nymphoides* (which see). The light green oblong, blunt lvs. are very characteristic and ornamental; petiole triangular, 1-2 in. high; the fls., produced on a scape, are pale yellow bordered white. Seed is produced very freely, and as the seed matures the scapes fall to the water, the seed ripens and sinks to the bottom, and when grown out-of-doors, sometimes renews itself the following season. The fl.-scape, as soon as it rests on the water, throws up a shoot, which produces another plant in a short time, which again produces fls., seeds and shoots, and so on. The plant may be grown in pots or tubs or planted out in shallow water in early summer.

WILLIAM TRICKER.
L. H. B.

LIMODORUM (*meadow gift*, from the Greek). *Orchidaceæ*. A name adopted by some authors for what has been known as *Calopogon*, comprising a half-dozen species of scapose cormous herbs bearing attractive rose or purple (rarely white) fls. in a spike or raceme. Transferred to this genus, the grass-pink (*Calopogon pulchellus*) is given the name *L. tuberosum*, Linn. All the species are found in E. N. Amer., from Newfoundland to Cuba and the Bahamas. *L. tuberosum* is sometimes transferred to bog-gardens; see *Calopogon* for cult. A southern species, *L. multiflorum*, Mohr, growing in Fla., is recommended for bog-planting S. The single lf. is linear: scape to 16 in. tall, bearing deep purple fls.; lateral sepals ovate, acute; petals ovate or obovate; middle lobe of lip broad-cuneate, about $\frac{1}{2}$ in. wide.

L. H. B.

LIMONIA (derivation uncertain). *Rutaceæ*. An invalid generic name usually misapplied to *Hesperethusa crenulata*, which see. A number of species belonging to very diverse genera were formerly placed in *Limonia*. See *Feronia*.

L. acidissima, Linn.=*Feronia Limonia*.—*L. acidissima*, Auct. (not Linn.)=*Hesperethusa crenulata*.—*L. angulata*, Wight & Arn.=*Merope angulata*.—*L. bilocularis*, Roxbg.=*Severinia buxifolia*.—*L. crenulata*, Roxbg.=*Hesperethusa crenulata*.—*L. Demeusei*, De Wild.=*Citropsis Preussii* (?).—*L. Engleri*, Perkins=Chatospermum glutinosum. *L. gabonensis*, Engler=*Citropsis gabonensis*.—*L. glutinosa*, Blanco=Chatospermum glutinosum. *L. Lacourtianna*, De Wild.=*Citropsis gabonensis* (?).—*L. monophylla*, Roxbg.=*Atalantia monophylla*.—*L. pentaphylla*, Retz.=*Glycosmis pentaphylla*.—*L. Pöggel*, Engler=*Citropsis Schweinfurthii* (?).—*L. Preussii*, Engler=*Citropsis Preussii*.—*L. scandens*, Roxbg.=*Lavanga scandens*.—*L. Schweinfurthii*, Engler=*Citropsis Schweinfurthii*.—*L. spinosa*, Spreng.=*Merope angulata*.—*L. trichocarpa*, Blance=Poncirus trifoliata. *L. trifolia*, Burm.=*Triphasia trifolia*.—*L. trifoliata*, Linn.=*Triphasia trifolia*.—*L. ugandensis*, Baker=*Citropsis Schweinfurthii*.—*L. Warnickei*, Engler=Balsanocitrus paniculata.

WALTER T. SWINGLE.

LINANTHUS (*flax flower*). *Polemoniaceæ*. By Gray, Peter and others included in *Gilia* as a section or subgenus, but by some authors kept distinct. *L. densiflorus*, Benth., is described on page 1337 as *Gilia densiflora*. It is advertised as "California phlox." It is an old garden annual, very attractive when sown thickly as it makes a mass of lilac bloom. The plant is native in the Coast ranges and valleys of Calif.

About a dozen West American *gilia*s are now included in this genus by some writers, one other of which, *L. androsæcus*, Greene (*Gilia androsæca*, Steud., p. 1337), is sometimes grown as a flower-garden annual.

L. H. B.

LINARIA (*Linum*, flax, which the lvs. of some species resemble). *Scrophulariaceæ*. Low herbs, sometimes subshrubs, several species cultivated for the oddly irregular flowers and others for the festooning foliage.

Annual, biennial, perennial: lvs. alternate, or sometimes subverticillate, in the erect-growing species mostly narrow and entire: fls. solitary in the axils, or in terminal racemes, yellow, white, blue or purple; corolla personate or grinning, 2-lipped, usually 1-spurred at the base (in rare or so-called *peloria* states 5-spurred); stamens 4, ascending in 2 pairs, slender; style 1: fr. a dry caps., opening by slits or pores near the summit, many-seeded.—Widely distributed, mostly in temperate parts of the northern hemisphere, of more than 100 species and with many hybrids. Occasionally the fls. of the common toad flax (*Linaria vulgaris*) are regular. When Linnaeus discovered this form, he took the plant to be of another kind and used for it the genus *Peloria*. This word *Peloria* is now used generically for the regular state of any normally irregular fl. Such monstrosities occur now and then, particularly in the *Scrophulariaceæ*.

In America, *linarias* are little known as garden plants, although they are worthy greater attention. They are of two general classes,—the hardy perennials (sometimes evergreen) and the annuals. The perennials are propagated by seeds and by division, usually the latter. All the species are of easiest culture in any ordinary soil and exposure, and are largely able to shift for themselves when once established. The annuals may be started indoors; or in warm situations they may be sown where the plants are to stand. Some of the trailing and caespitose species are good for rock-gardens.

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A. Plant completely trailing: lvs. palmately veined and lobed. Subgenus *Cymbalaria*.)

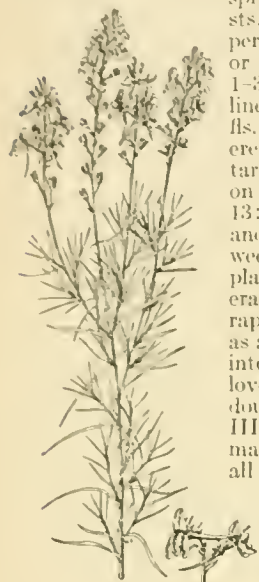
1. *Cymbalaria*, Mill. (*Antirrhinum Cymbalaria*, Linn.). KENILWORTH IVY. MOTHER-OF-THOUSANDS. Perennial tender glabrous herb, but sowing itself freely from seeds, long-trailing and rooting at the joints: lvs. cordate-orbicular or reniform, 5-7-rounded-lobed, on slender stalks longer than the blades: fls. solitary on the axils, on slender sts., small but pretty, lilac-blue with a yellowish throat: caps. globular, splitting from the top. Eu. Var. *alba*, Hort., has white fls. Var. *rosea*, Hort., has pale pink fls. Var. *maxima*, Hort. (*L. pallida*, Hort.), has large light-colored fls. Var. *globosa*, Hort., forms a compact globular plant: fls. lilac.—The Kenilworth ivy is one of the most familiar of trailers on greenhouse bottoms and in odd corners; also as a trailing basket-plant in greenhouses and dwelling-houses. It is of the easiest cult., particularly in a moist and partially shaded place. Prop. by division of the long sts. or by seeds. It will not stand frost, but the plant will spring up year after year from seed, becoming essentially annual. It has become established in the open in many parts of the E. It is a good basket-plant for poorly lighted places and is a continuous bloomer. By some botanists, it is made the type of the genus *Cymbalaria*.

2. *æquitribloba*, Spreng. Close-growing creeping evergreen, perennial, with long trailing branches: lvs. small, roundish or reniform, fleshy, mostly opposite, entire or with 3-5 short mucronate lobes: fls. pale mauve on pedicels nearly equaling the lvs.; palate large, reddish purple; calyx-segms. very narrow. S. Eu. B.M. 2941.

AA. *Plant erect or nearly so (sometimes decumbent at base): lvs. long.*

B. *Fls. yellow.*

3. *vulgaris*, Mill. (*Antirrhinum Linaria*, Linn.). TOAD-FLAX. BUTTER-AND-EGGS. Vigorous perennial, spreading freely by underground sts. and in time forming large and persistent patches: sts. strict, nearly or quite simple, slightly glaucous, 1-3 ft. high: lvs. many, scattered, linear, somewhat narrowed below: fls. in a terminal spicate raceme, erect-spreading, with hanging nectary spur, sulfur-yellow, but orange on the bearded palate. Eu. A.G. 13:469. — Extensively naturalized, and commonly regarded as a bad weed; but it infests chiefly waste places, and although difficult to eradicate it does not spread very rapidly. Now and then it appears as an ornamental plant. It is more interesting to the general planter than to the gardener. A double-fl. form is figured in G.C. III. 18:554. The peloria forms may have 5 spurs, or no spurs at all (R.H. 1851:433).



2177. *Linaria bipartita*.
($\times \frac{1}{2}$)

sessile, entire: fls. bright yellow, with deeper color on the palate, in long wand-like terminal racemes. Macedonia; perhaps a broad-lyd. form of *L. dalmatica*. Gn. 45:110. J.H. III. 30:469. — A good hardy plant, bearing its snapdragon-like fls. most of the season. Var. *speciosa*, Hort., is a showy form or strain with large lemon-yellow fls. bearing an orange-yellow mark on lower lip: 2-3 ft.: blooms the first year from early-sown seeds, giving excellent cut-bloom.

5. *dalmatica*, Mill. Stout erect perennial, 3-4 ft., forming a large clump: lvs. glaucous, oblong-lanceolate to linear-lanceolate, acute: fls. large, bright yellow, borne at the tops of the branches in a long loose spike; spur straight, much exceeded by the corolla. S. E. Eu. — It is probably to this species or to the last (No. 4) that *L. hybrida* and other garden yellow-fl. forms belong.

BB. *Fls. blue or purple (running to white in some cases).*

C. *Perennial border plants.*

6. *alpina*, Mill. Compact-tufted plants, 6 in. or less high, with weak and spreading fl.-sts.: lvs. linear or lanceolate, mostly in 4's: fls. in short racemes or heads, blue with an orange-colored palate, the straight or slightly curved, sharp spur as long as the corolla. Alps. F.S. 20:2128. G.C. II. 14:105. — A pretty little alpine, blooming in July and Aug. Var. *nana rosea*, Hort., is said to be a dwarf and very distinct form.

7. *triornithophora*, Willd. (*Antirrhinum triornithophorum*, Linn.). Fig. 2178. Glaucous, 2-3 ft. tall: lvs. ovate-lanceolate, in 3's or 4's: fls. about 3 in a whorl (thence the name, *bearing three birds*), rather large, slender-stalked, violet- and purple-striped, with orange palate, about 1 in. long, the spur inflated above and exceeding the lobes. Spain, Portugal. B.M. 525. F.S. 22:2297. H.U. 3:100. — A handsome and interesting plant, rarely seen in American gardens.

8. *repens*, Mill. Erect, or decumbent at base, bushy, 1-2 ft. or more, glabrous, with slender creeping root-stock: lvs. whorled or crowded near the base but scattered above: fls. not large, fragrant, in short racemes,

forming a terminal panicle, nearly white but striped with purplish veins; corolla less than $\frac{1}{2}$ in. long; spur variable, usually short and conical. Eu. — The *L. repens alba* of lists may belong here. *L. repens* is sometimes adventive in this country.

9. *purpurea*, Mill. (*Antirrhinum purpureum*, Linn.). Erect, branched glabrous perennial, 1-3 ft.: lvs. linear or linear-lanceolate, mostly whorled: fls. bright purple, in long racemes, the throat bearded with white hairs, the tube striped; spur about the length of corolla, curved; calyx-lobes linear-acute. S. Eu. B.M. 99.

10. *origanifolia*, DC. Perennial (sometimes described as annual), ascending, 8-10 in.: lvs. oblong or obovate, short-stalked, the upper alternate and lower opposite: fls. pale purple, rarely white, yellow in the throat, in a slender loose raceme; calyx-lobes linear or linear-spatulate, villous. S. Eu.

CC. *Annual plants of the fl.-garden.*

(See R. H. 1896, pp. 371-4.)

11. *bipartita*, Willd. Fig. 2177. A foot high, erect, branching, with scattered or verticillate linear lvs.: fls. large, in a long racemose spike, violet-purple, with the palate orange-colored above and whitish toward the base, the spur curved, about as long as the corolla, standing oblique or horizontal; upper lip parted. Portugal, N. Afr. — Old-time annual, but it has never been popular in N. Amer. Var. *alba*, Hort., has yellowish white fls. Gn. 74, p. 203. Var. *splendida*, Hort., has handsome deep purple fls. There is also a var. *striata*, Hort. The Excelsior forms probably belong here or with No. 12.



2178. *Linaria triornithophora*, an old-fashioned plant. ($\times \frac{1}{2}$)

12. *maroccana*, Hook. f. Plant annual: spike much shorter and denser than in *L. bipartita*: fls. bright violet or rose, with a whitish palate, the spur long, pointed, as long as the pedicel and usually hanging nearly parallel with the axis of the spike: lvs. many, linear, scattered or whorled, hairy. Morocco. B.M. 5983. A var. *rosea*, Hort., is mentioned, with deep carmine-rose fls.

13. *reticulata*, Desf. Fls. pubescent, purple, reticulated with purple, the palate yellow or copper-yellow, the spur pointed and shorter than the corolla and pointing downward: spike short: lvs. linear, scattered or verticillate. Portugal. J.F. 3:260. — An old garden plant, but little known in Amer. Runs into two or three forms.

14. *heterophylla*, Desf. (*L. aparinoides*, Dietr.). Annual, erect, 2-3 ft., with scattered linear or lanceolate, somewhat fleshy, lvs.: fls. straw-colored, with a yellow palate, in spicate racemes more or less branching at base; calyx-lobes linear and obtuse or somewhat acute. Morocco, Sicily, etc. B.M. 6041. Var. *splendens*, Hort., with violet-bronze fls., is mentioned, possibly a hybrid.

L. Broussonetii, Chav. (*L. multipunctata*, Hoffmgg.). Low annual, with yellow, black-spotted fls., orange on the palate, and lanceolate or linear lvs.: 5-8 in. high, mostly upright. Spain. — *L. canadensis*, Dum., is a weedy native plant, of no value to the garden, although sometimes making a considerable show in fields in spring: it

is annual or biennial, strict, 1-2 ft., with very small blue fls.—*L. globosa*, Hort. Described as making close rounded masses, with glaucous-green lvs. and lilac fls. *L. Cymbalaria*(?).—*L. hepaticifolia*, Steud. A good alpine, making a very low mat: fls. purple: lvs. cordate or reniform, lobed. Corsica, Sardinia.—*L. multipunctata*, Hoffmgg.—*L. Broussonetii*.—*L. Pancheri*, Hort. (not Janka), is said to be a beautiful dwarf species with large canary-yellow fls. and narrow-lanceolate lvs., from the Orient.—*L. petraea*, Jord. Low plant, with rose-colored fls. tinged violet and yellow on the tip. Ea.—*L. saxatilis*, Hoffmgg. & Link. Rockwork perennial, trailing, with thickish lanceolate lvs., and yellow fls. in short clusters. Spain.

L. II. B.

LINDELÖFIA (Friedrich von Lindelof, a German patron of botany). *Boraginaceæ*. Two species of erect hardy herbaceous perennials from the high Himalayas, one cultivated for the flowers resembling forget-me-not.

This genus has the habit and nutlets of *Cynoglossum*, but the stamens of *Cynoglossum* are included, while those of *Lindelofia* are exserted: lvs. radical and cauline, the latter alternate and ovate to linear-lanceolate: fls. blue or purple, often very dark, in long dense racemes; sepals somewhat enlarged in fr.; corolla with cylindrical tube and cone-like scales in the throat, the lobes obtuse; stamens 5, with large linear-oblong anthers; ovary 4-lobed: nutlets with hook-tipped bristles.

longiflora, Gürke (*L. spectabilis*, Lehm. *Cynoglossum longiflorum*, Benth.). Pilose: lvs. oblong-acuminate, the upper ones heart-shaped or clasping at the base: fls. deep blue; tube $\frac{1}{4}$ in. long and lobes shorter. B.R. 26:50. J.H. III. 31:235. Var. *afghanica*, Hort., is offered, 1 ft., of spreading habit. G.W. 10, p. 90.—The species is variable, particularly in size of corolla. It usually grows about 2 ft., flowering freely in May and later. The racemes are about 6 in. long, and have 8-12 fls. The plant is likely to be winter-killed unless given a sheltered place, good drainage and winter covering. It is not fastidious as to soil. Easily prop. by division. It seeds freely and flowers the second year from seed.

WILHELM MILLER.
L. H. B.†

LINDEN: *Tilia*.

LINDENBÉRGIA (J. B. W. Lindenberg wrote on the liverworts, 1829). *Scrophulariaceæ*. About 16 annual or perennial herbs of tropical or warm parts of Asia and Afr., differing from *Mimulus* in having a campanulate rather than tubular calyx and the anther-cells separate: corolla 2-lipped, the tube cylindrical; upper lip short and broad, emarginate or lobed; lower lip larger, 3-lobed and spreading; stamens 4, didynamous, included: caps. oblong or ovoid, dehiscent: plant decumbent or ascending, sometimes woody at base, with opposite dentate lvs. (or the upper ones alternate): fls. nearly sessile, solitary or in terminal racemes or spikes, the bracts leafy. *L. grandiflora*, Benth., has recently been mentioned in horticultural literature abroad. It is a good greenhouse plant in England, with yellow fls.: soft-hairy, somewhat scandent: lvs. ovate, acuminate, coarsely serrate: fls. 1 in. long, in terminal leafy spikes. Himalaya, to 6,000 ft. altitude. B.M. 7738. G.C. III. 32:213; 53:27. G.M. 45:616; 56:41. G. 24:671.—Mentioned sometimes as annual, but it is perennial in cult. It is a valuable winter-blooming plant, keeping in good condition 3 months, and may be grown in compact bushy form by being cut back.

L. H. B.

LINDÈRA: *Benzoïn*.

LINDSÄYA (Archibald Lindsay, early English botanist). Sometimes spelled *Lindsæa*. *Polypodiaceæ*. About thirty species of tropical ferns, of both hemispheres, none of which is advertised in Amer. They are very difficult of cultivation, and are apparently adapted only as fancier's plants. Schneider, in his "Book of Choice Ferns," says they usually die soon after importation, even if apparently in good condition on arrival. In their native habitat, he says, these ferns usually creep about in poor, stony soil, which is

frequently drenched and washed away by rain. They need a high temperature and humid atmosphere. Some success has been attained by placing lindsayas in pots nearly filled with corks, in which they are firmly held by two or three pieces of turfy loam, and by imitating in other ways the natural conditions described above.

LINNÆA (named after Linnæus, at his own request; it was his favorite flower). *Caprifoliaceæ*. **TWIN-FLOWER**. Ornamental hardy plant grown sometimes for its delicate pink or purplish flowers.

Evergreen trailing subshrub: lvs. opposite, small, crenate, petioled, without stipules: fls. in pairs on slender upright peduncles; calyx 5-parted; corolla campanulate, 5-lobed; stamens 4; ovary 3-celled: fr. dry, indehiscent, 1-seeded.—Only one species in the colder regions of the northern hemisphere. There is an interesting monograph of this variable species by Witstroek in *Acta Hort. Berg.* 4, No. 7, 187 pp., 13 pl. (1907), where about 150 varieties are described and figured.

The twin-flowers are half-woody plants with trailing slender thread-like stems, small, usually roundish persistent leaves and slender-stalked, nodding, pinkish or



2179. *Linnæa borealis*. (× $\frac{1}{4}$)

nearly white, campanulate twin flowers. They are hardy North and are graceful, dainty plants for rockeries, preferring a shaded moist position and porous, peaty or humous soil. Propagation is usually by division or by cuttings of soft or half-ripened wood under glass.

borealis, Linn. Fig. 2179. Sts. slender, slightly pubescent: lvs. short-petioled, roundish or obovate, with few crenate teeth, usually ciliate and with scattered hairs above, $\frac{1}{4}$ – $\frac{3}{4}$ in. long; fls. pedicelled in 2's at the top of slender, upright peduncles; corolla rose-colored or white, $\frac{1}{2}$ – $\frac{1}{2}$ in. long, fragrant, in the typical form campanulate, with the constricted portion at the base much shorter than the calyx. June–Aug. N. Eu. and N. Asia. Gn. 24, p. 177. G. 1:536. M.D.G. 1910:138. Var. *americana*, Rehd. (*L. americana*, Forbes). Differs chiefly in the corolla being distinctly tubular at the base, the tubular part exceeding the calyx: lvs. usually glabrous, but ciliate near the base. N. Amer., Lab. to Alaska, in the mountains south to Md. and Calif. B.B. (ed. 2) 3:276. Var. *longiflora*, Torr. (*L. longiflora*, Howell). Fls. more funnelform, $\frac{1}{2}$ in. long or slightly longer; peduncles 2-3 in. long: lvs. generally somewhat larger. Wash. to Calif. A var. *majior* is listed. In Fig. 2179, the two large lvs. in the foreground do not belong to *Linnæa*.

For *L. floribunda*, Brann & Vatke, and other species, see *Abelia*.

ALFRED REHDER.

LINNEÅRA (named apparently for Linnaeus). *Orchidaceæ*. The Rules of Horticultural Nomenclature adopted by the subsection of Nomenclature at the International Horticultural Congress at Brussels, 1910, provide that "multigeneric hybrids receive a conventional generic name, preferably that of a distinguished man, to which is added the termination *ara*. A distinct generic name will be formed for each different combination of genera. Thus all combinations of the genera *Brassavola*, *Cattleya*, *Laelia* and *Epidendrum*, no matter in what order they may be intercrossed, receive the same generic name which would be, for example, *Linneara*." The Royal Horticultural Society (London) had proposed to the Congress that "Future multigeneric hybrids (combining three or more genera) should be given a conventional name consisting of the name of some person eminent as a student or as a grower of orchids, followed by the termination '*ara*'." "A separate generic name should be coined for each distinct combination of genera. Thus, *Brassocattleya* × *Epilaelia*, and *Brassodendrum* × *Brassocattleya*, and *Brassolaelia* × *Epicattleya*, and *Brassolaelia* × *Epidendrum*, and all other possible combinations of those four genera would be designated by one name, e.g., *Adamara*, while a second generic name, e.g., *Linneara*, would need to be coined for *Dialaelia* × *Brassocattleya*, and this would stand for all combinations of the four genera *Diacrium*, *Laelia*, *Brassavola*, and *Cattleya*."

The Congress adopted *Linneara* for the hybrids of the genera *Brassavola*, *Cattleya*, *Laelia*, *Epidendrum*. The name *Adamara* was not adopted. Neither name has become current; see also *Lowiara*.

L. H. B.

LINOSPADIX (Greek, *linear spadix*). *Palmaceæ*. Dwarf unarined palms varying considerably in foliage.

Flowers monocious, spirally arranged on the erect spadix which appears among the lvs.: lvs. terminal, flabelliform, deeply 2-cut, the apex of the lobes sometimes cut and thread-like.—Eight species all from New Guinea. The genus is allied to *Bacularia*, but *Bacularia* has premorse lf.-segs. and erect anthers fastened at the base, while *Linospadix* has acuminate lf.-segs. and versatile anthers fastened on the back. *Linospadix* is distinguished from *Howea* (which see) by the stamens 6-9; pistillate fls. with 6-9 stamens; ovule parietal. The best known species, *L. Petrickiana*, is of uncertain botanical affinity. The name does not appear in botanical literature. This is a handsome pinnate-lyd. palm of compact growth and well furnished with foliage, at least while in a young state. In its juvenile condition, the lvs. of *L. Petrickiana* are simply bifid, the pinnate form gradually appearing as the plant attains age. It was intro. in 1899 by Sander & Co., who say: "The slender, alternate pinnae are slightly arched. The base is netted with brown fiber, small, hair-like glumes of the same color being apparent on the younger fronds and leafstalks. The young fronds are colored similarly to those of *Areca llesmannii*, and when developing have the luster and brilliancy of new copper." Cultural conditions suited to the needs of calamus and *dæmonorops* will be most likely to succeed with *linospadix*, and include a temperature of 70°, plenty of water, and some shade throughout the year.

Petrickiana, Hort. Sander. Pinnae once cut from the apex to a third or fourth the length of the pinna; laterally cut about six-sevenths of the way from the tips of the segms. to the rachis; premature basal lvs. cut once from the apex to half their length, the 2 lobes uncut. G.C. III. 24:299.

L. Leopoldii, Hort. Sander. Uncertain as to botanical affinity, perhaps the preceding. Name never published in botanical literature. Shown at Ghent in 1903. G.C. III. 33, suppl. to April 25. —*L. Michelitzii*, C. H. Wright. A low, stemless palm, with a densely crowded cluster of 2-cut flabelliform, plicate lvs.: spadix slender, nodding, about 1 2½ ft. long, bearing numerous attractive, pale yellow fls. New Guinea, B.M. 8095. Not in cult. in Amer., but an attractive little plant.

N. TAYLOR.

LINÓSYRIS (*Linum* and *Osyris*, which genera it resembles). *Compositæ*. One species, *L. vulgâris*, Cass., *GOLDILOCKS*, of Eu., is a good hardy perennial, growing 1½-2 ft. high, and bearing numerous small pale yellow usually rayless heads: sts. strict (from a hard root), striate, glabrous, bearing many alternate, small, linear, entire lvs.: involucre imbricated, the numerous narrow bracts shorter than the florets and pappus: achene compressed and silky. The plant grows natively in rocky and stony places and along gravelly banks of rivers in England, Wales, and through Cent. and S. Eu. to the Caucasus. It is an excellent late summer and fall bloomer, thriving well in any good garden or border. Prop. by division.

The genus *Linosyris* is referred to *Aster* by many botanists, the above species then becoming *Aster Linosyris*, Bernh. It is also known as *Chrysocoma vulgaris*, Linn. Horticulturally, it is distinct, with its yellow heads and peculiar habit. From *Aster* it differs technically in the absence of rays and in yellow flowers, but rayed heads are sometimes found. In this work, the yellow-flowered asters are kept distinct in this genus and *Calimeris*. As usually separately defined, *Linosyris* contains several species.

L. H. B.

LINUM (classical name). Including *Cathartolimum*, *Linaceæ*. FLAX. Ornamental flowering plants, annual and perennial; one is the fiber-yielding flax.

Erect-growing plants, bearing tough cortex, with narrow alternate (rarely opposite) and mostly entire lvs., and showy 5-petaled fls. which open in the sunshine; stamens 5 and alternate with the petals, usually united at the base, staminodia sometimes present: ovary single, 3-5-loculed, bearing as many styles as locules, and ripening into a dry caps. which may or may not be dehiscent: fls. red, blue, yellow, white, borne in terminal racemes or cymes, and, although each fl. may be short-lived, the continuity of bloom makes the plant showy.—Species 90-100, in temperate and warm regions about the globe, about one-fourth of which are in the U. S.. There are two horticultural sections,—the annuals and perennials. All are of easy cult. in an open and warm place, fully exposed to the sun. Seeds of the annuals may be sown where the plants are to bloom or they may be started under glass. The perennials often bloom the first year from seed, and seeds are often used to prop. them; but the plants may be divided. The species with capitate stigma and glandular sepals, mostly yellow-fl., are by some authors separated as *Cathartolimum*.

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A. Plant annual: fls. red or blue.

B. Bloom of the red series.

1. *grandiflorum*, Desf. FLOWERING FLAX. Fig. 2180. Erect, branchy, 1-2 ft., glabrous: lvs. many, alternate, broadly lanceolate to oblong, sessile or nearly so: fls. terminating very slender pedicels which are 1-3 in. long, the obovate petals wide-spreading (fl. 1-1½ in. across, and something like a single-fl. pink) and much exceeding the pointed scarious-edged sepals. N. Afr. B.M. 4956. R.H. 1848:401.—Very serviceable garden annual, and popular for its glossy bright fls. The color varies in the shades of red. Var. *rubrum* has bright red fls. Var. *kermesinum* is crimson. Var. *coccineum*, Hort., is a scarlet-fl. form.—In a warm, sunny place, the flowering flax makes a very satisfactory plant of long period of bloom. It is not adapted to cutting, since the fls. are not durable. Will not stand frost.

BB. Bloom blue.

2. *usitatissimum*, Linn. FLAX. Much cult. for linseed and for fiber, and running wild along railroads and in fields: 2-3 ft. high, very slender-branched, glabrous: lvs. small, linear or lanceolate, acute, alternate: fls. about $\frac{1}{2}$ in. across, light blue, soon withering: pod large, mostly exceeding the scarious-edged sepals, nearly or quite indehiscent, the septa not ciliate. L.

humile, Mill., also cult. and sometimes escaped, is lower and has a dehiscent caps. with ciliate septa. It is probably only a form of the

above, and it has run wild in this country. —Flax has been cult. from time immemorial, and it is unknown in an originally wild state. Some authorities consider it to be a modified form of *L. perenne*; others think it to be derived from *L. angustifolium*, Huds.,

an annual or perennial species with small fls., short linear lvs., and decumbent st., growing from England to W. Asia.

AA. Plant perennial: fls. yellow, white, or blue.

B. Bloom yellow (*L. trigynum*, which may be sought here, will be found under the genus *Reinwardtia*).

3. *flavum*, Linn. Erect from a somewhat woody base, glabrous, 1-2 ft.; lvs. lanceolate or linear, alternate: fls. golden yellow, in a much-branched cyme, the showy petals much exceeding the glandular-ciliate sepals. Eu. B.M. 312.—A good half-hardy perennial, but not popularly known in this country.

4. *virginianum*, Linn. (*Cathartolimum virginianum*, Reichb.). Perennial, producing suckers, 1-2 ft., glabrous, branched above: lvs. thin and deep green, elliptic-lanceolate to narrow-oblong or the lower spatulate, 1-nerved: fls. yellow, about $\frac{1}{2}$ in. broad, scattered; sepals ovate, short-pointed, entire or nearly so; styles distinct: caps. depressed-globose, 10-celled. Maine to Ga. and Ala.—Offered as a good garden perennial.

5. *arboreum*, Linn. Small shrub, spreading: lvs. wedge-shaped, obtuse, recurved: fls. few and large, clear yellow, in close clusters; sepals acuminate. Crete. B.M. 234. Gn. 77, p. 435.

BB. Bloom white.

6. *monogynum*, Forst. Variable glabrous perennial 1-2 ft. high, sometimes woody at base, the sts. simple or branched, erect or spreading: lvs. many, scattered, 1 in. or less long, linear-oblong to linear-subulate, 1-3-nerved: fls. white, often 1 in. diam., in terminal corymbs; sepals acute, ovate to ovate-lanceolate; styles united at base: caps. broadly ovoid, large. New Zeal. B.M. 3574. J.H. III. 57:13.—An attractive species.

7. *salsoloides*, Lam. Perennial, evergreen, 1 ft., woody at base, the sts. branched and somewhat twisted: lvs. small, setaceous: fls. white with purple eye; sepals

ovate, acuminate, with glandular hairs at middle. Mediterranean Alps. G.C. III. 54:42. G. 36:681 (var. *nanum*).—A showy species.

BBB. Bloom blue (running into white varieties).

8. *perenne*, Linn. Fig. 2181. Erect-growing and branchy, glabrous, 1-2 $\frac{1}{2}$ ft. tall: lvs. linear and acute, alternate: fls. rather small, azure-blue (there is a white-fl. form; var. *album*, Hort.), on the ends of slender pedicels, the styles and stamens of different lengths (fls. heterogonous) in different fls.; caps. ovoid, dehiscent, on inclined pedicels. Eu.—Worthy hardy perennial, summer-blooming, often flowering the first year from seed. *L. sibiricum*, DC., belongs with this species.

9. *Lewisii*, Pursh (*L. perenne* var. *Lewisii*, Eaton & Wright). PRAIRIE FLAX. The W. American representative of the above, and scarcely distinguishable from it except that the fls. are not heterogonous, pedicels more erect in fr.; calyx-nerves not evident: fls. 1 $\frac{1}{2}$ in. across, clear sky-blue, very pretty. Wis., west and south.

10. *austriacum*, Linn. (*L. perenne* var. *austriacum*, Voss.). Lvs. linear, punctate: fls. rather small, violet-red or light blue: fruiting pedicels horizontal or reflexed. Austria.—Hardy N., growing 1-2 ft. high and blooming all summer.

11. *alpinum*, Linn. (*L. perenne* var. *alpinum*, Voss). Low, about 6 in., with erect shoots: lvs. small, crowded below, pellucid-dotted, linear-subulate: fls. few, large, blue; inner sepals obtuse, the outer ones somewhat acute. Eu.

12. *narbonneuse*, Linn. One to 2 ft. high, forming a spreading clump, glabrous and slightly glaucous, and



2180. *Linum grandiflorum*. (Natural size)



2181. *Linum perenne*. ($\times \frac{1}{2}$)

very handsome for rockwork: lvs. linear-lanceolate, pointed, alternate: fls. 1 $\frac{1}{2}$ in. across, on slender pedicels in loose panicles, azure-blue, with white eye and white stamens. Eu. G.C. III. 50:468. Gn. 52, p. 401. G. 26:460.—Blooms in late spring and early summer; a good hardy species.

L. campanulatum, Linn. Perennial yellow-fl'd. species from S. Eu. 1-1½ ft., glaucous; lvs. on st. oblanceolate, acuminate, alternate. 1. B.C. 13:1254.—*L. Chamissoensis*, Schiele (L. Maerck, B.M. 5474, not Benth.). Perennial, woody at base, with scarlet buds and yellow fls.; lvs. stiff, lanceolate, acuminate; sepals ovate, acuminate; 1 ft. Chile.—*L. pubescens*, Soland. Perennial, with large pink fls. shaded with dark purple lines, the petals 3 times as long as calyx; lvs. oblong and obtuse to lanceolate and acute. Asia Minor.—*L. trigynum*, Roxbg. = Reinwardtia trigyna.

L. H. B.

LÍPARIS (Greek, *fat, shining*). *Orchidaceæ*. Erect little plants with stems in some species 1 foot high, bearing one or several leaves and a terminal raceme of small, rarely medium-sized flowers.

Herbs, terrestrial or epiphytic; sts. sometimes thickened at the base into a small pseudobulb, sheathed by scales; lvs. few, broad, contracted into sheathing petioles; fls. whitish, greenish yellow or purplish; sepals and petals nearly equal, linear, spreading; column long; lip nearly plane, often with 2 tubercles above the base.—A large genus, containing over 100 species, distributed over the warm and temperate regions of the entire earth. By some, the name *Leptorchis* is used for this genus, but *Liparis* is retained by the "nomina conservanda" of the Vienna Congress.

L. liliifolia should be planted in well-drained soil; a shady bank is preferable. *L. Læselii* delights in a wet situation, just at the edge of the water.

liliifolia, Rich. TWAYBLADE. Plants 4-10 in. high; lvs. oval or ovate, 5 in. long; raceme with many purplish fls.; labellum large, wedge-obovate. Succeeds in well-drained soil on shady banks; woods and thickets, E. N. Amer. B.B. 1:476. A.G. 12:153 and 13:517.—Procureable from Dutch bulb-dealers and dealers in native plants.

Læselii, Rich. Plants 2-8 in. high; lvs. elliptic-lanceolate, 2-6 in. long; raceme with few greenish fls.; lip obovate pointed. In wet thickets, N. Amer. and Eu. B.B. 1:477. G.C. 11:21:144.

L. atropurpurea, Lindl. Plants 1 ft. or more high; lvs. 2-4, nearly round, acuminate plicate, near together at the upper part of the st.; raceme many-fl'd.; fls. chocolate-purple; lip oblong, obtuse, recurved. June. Ceylon. B.M. 5529.—The most ornamental of the genus.—*L. Cailletii*, Finet. Dwarf; racemes several-fl'd.; scape 4-winged; lvs. membranous, not plicate. French Guinea.—*L. lacerata*, Ridl. Racemes about 8 in. long; sepals and petals yellowish, oblong, obtuse; lip orange-red. Borneo.—*L. nana*, Rolfe. Plant very small; fls. dark purple, remarkable in having a very broad, nearly straight column. Annam.—*L. rhodochila*, Rolfe. Scape many-fl'd.; sepals and petals light green; lip reddish crimson. Java.—*L. tabularis*, Rolfe. Raceme lax; fls. purple; dorsal sepal oblong-lanceolate, the lateral oblong; petals filiform; lip reniform, denticulate. Penang. B.M. 8195.—*L. trianthusa*, Reichb. f. Raceme loosely many-fl'd., the rachis red; sepals strap-shaped, lemon-yellow; petals filiform, arched, red; lip nearly orbicular, golden yellow, red-striped. Malay Penin. B.M. 7804.—*L. Wärpuri*, Rolfe. Only a few inches high; sepal 1- or 2-fl'd.; fls. light green, with dark green disk. Madagascar.

HEINRICH HASSELBRING.

GEORGE V. NASH.†

LÍPPIA (Dr. Auguste Lippi, French traveler, 1678-1703). Including *Aloysia*. *Verbenaceæ*. Herbs and shrubs, grown for the ornamental bloom, and one as a ground-cover; the lemon verbenas of florists is one of them.

Mostly shrubby, with opposite or 3-whorled (rarely alternate) lvs., which are entire, dentate or lobed; fls. small and often lantana-like, in heads or spikes, mostly white, rose or purplish; corolla 4-lobed, oblique or 2-lipped, the tube cylindrical and straight or curved, the lobes broad and usually retuse; calyx 2-4-toothed or cleft, inclosing the dry fr. which becomes 2 separate nutlets; stamens 4, didynamous, attached at the middle of the corolla-tube, included or very nearly so; ovary 2-celled, each cell 1-ovuled.—Species about 125, nearly all in Trop. Amer., but 2 or 3 African and 1 or 2 widely dispersed in warm countries. The genus is botanically nearer *Lantana* than *Verbena*, although the common forms of all three genera are very unlike horticulturally. Some species of *Lippia* have their spikes crowded into dense heads, like *Lantana*. The drupe in *Lippia* is dry, but in *Lantana* it is often juicy, and in *Lantana* the

calyx is more or less truncate and the corolla not bilabiate.

The one well-known cultivated *lippia* is lemon verbenas (*L. citriodora*), an old-fashioned favorite, with delightfully fragrant foliage, a sprig of which was often included in mixed bouquets. It is a low-growing tender shrub, with long narrow pointed entire leaves, which are usually borne in threes. In summer, it bears minute flowers in a pyramidal panicle, composed of many-flowered spikes, which appear in groups of three at decreasing intervals along the main axis. In southern California it attains a large size.—Culture by William Scott: A florist should always have a few lemon verbenas. Save a dozen plants in spring, shift them on as required, and in the summer plunge the pots outside. At the approach of frost bring them into the greenhouse, stand them under the lightest and coolest bench, and give them water enough merely to keep the wood from shriveling. In early February shake the plants out of the pots, shorten the unripened and weak wood, repot in fresh soil, using 4-inch pots, and start the plants into fresh growth in a temperature of 55°. In a few weeks they will be covered with new growths suitable for cuttings. Cuttings root readily in about three weeks. The sand of the cutting-bench should be a little warmer than the air. Water the sand twice a day, and keep it well soaked. Never allow the cuttings to wilt from sunshine or dryness. Transfer the cuttings when rooted to 2-inch pots, and in April shift to 3-inch pots, plunging them in a mild hotbed, where by the middle of May, with one pinching, they will have become fine, bushy plants. They need frequent syringing to prevent attacks of red-spider.

In California, Arizona, Mexico, Australia, the plant known as *L. repens* (properly *L. canescens*) is now an important ground-cover or lawn plant. The many thousands of acres thus covered are said all to have come from plants secured in a twelve-ounce box from the Botanic Garden in Rome by F. Franceschi, of Santa Barbara, in 1898.—Culture by Franceschi: It thrives in any soil, no matter how poor, rapidly covering the ground with a very dense matting. It will smother all weeds in short time, and the more trodden upon the better it grows. It requires much less water than other lawn plants, and saves the trouble of mowing. It will stand severe heat and many degrees of cold, and can easily be established on sloping grounds. It will never become a pest difficult to eradicate, having no underground runners. Have the ground well worked and pulverized, leveled and rolled, if possible. No manure is recommended. It seeds very sparingly or not at all. The best and quickest way to propagate it is by planting small sods (of 2 square inches) at a distance of 1, 2, or more feet apart, as one may prefer. The closer planted, the sooner the ground will be carpeted. Each small sod contains many joints, and from each joint runners and roots soon appear that will branch in every direction and will anchor it in the ground, rooting again as they run. Press and firm the sods in the ground, and give sufficient water to start them to grow. Occasional rolling will be of advantage. Frequent walking over it will have the same effect. If the tiny lilac flowers (much sought by the bees) are not desired, they can easily be removed with an ordinary lawn-mower. During the dry season, water must be given, with a lawn sprinkler or otherwise, at intervals as the local conditions suggest.

A. Fls. in slender naked spikes.

citriodora, Kunth (*Aloysia citriodora*, Ort.). LEMON VERBENA. Small shrub, glabrous, the branchlets striate and more or less scabrous; lvs. in whorls of 3 or 4, lanceolate, short-stalked, glabrous, densely covered beneath with glandular dots, entire or toothed at the middle, lemon-scented; spikes whorled and axillary or collected in terminal panicles, which may be 3 in. long

and wide: fls. white, small, in summer and autumn. Uruguay, Argentina, Chile. B.M. 367 (as *Verbena triphylla*). Sometimes grown as standard and tree-like. G.C. II. 11:301.

ligustrina, Brit. (*L. lycioides*, Steud. *Verbena ligustrina*, Lag.). Tall shrub, often spiny, the branches more or less pubescent: lvs. small, coriaceous, opposite, elliptic-oblong or lance-oblong, attenuated to petiole, obtuse or acute, the margin somewhat revolute, entire or serrate at middle: racemes somewhat crowded, canescent, 2-3 in. long; fls. small, white, vanilla-scented; calyx campanulate, 5-costate, hirsute, with subulate teeth; corolla exceeding calyx, the throat villous. Mex. to Argentina.—Offered in S. Calif., where it is said to withstand drought exceedingly well.

chamædrifolia, Linn. Shrubby, half climbing, branches 4-angled and pubescent: lvs. aromatic, opposite, very short-petioled, ovate, acute, coarsely serrate, margin revolute, shining above and more or less tomentose beneath: racemes 3-5 in. long, paniculate; fls. small, rosy lilac; calyx ovate, hirsute, the short teeth ovate-acuminate. Brazil, Argentina.—Offered in S. Calif.

urticoides, Steud. Tall shrub, with strict terete glabrous branches: lvs. dark green, rough, not aromatic, 3 in. long, opposite, ovate or oblong, attenuated into the petiole, acute, crenate-serrate: racemes paniculate; fls. white, vanilla-scented; calyx tubular, pilose below, partially 4-toothed, the teeth subulate-cuspidate. Peru, Brazil, etc.—Offered in S. Calif.

AA. Fls. capitate or in short dense spikes, with broad bracts.

canescens, Kunth (*L. repens*, Hort., not Spreng.). St. somewhat woody at the base and rooting, widely spreading, canescent: lvs. small, from spatulate to oblong and lanceolate, attenuate to petiole, acute, dentate toward apex: heads ovoid or subcylindrical; the bracts herbaceous, obovate-cuneate, acuminate, narrowly membranous-margined, imbricated; corolla conspicuously larger than in related species, rosy, with a yellow throat; calyx short 2-toothed, with villous keels; bracts of fl.-head shorter than the corolla-tube, with villous margins. S. Amer., in dry, grassy places.—This plant, under the name of *L. repens*, is exceedingly useful in Calif. as a ground-cover, especially to persons who do not care to go to the expense of keeping up a grass-lawn. The tops sometimes freeze in the region of San Francisco, but the plants come on well in spring. By keeping the area mown, the weeds are not very troublesome.

nodiflora, Michx. (*Verbena nodiflora*, Linn. *Zapania nodiflora*, Lam. *Phyla nodiflora*, Greene). Sometimes described as annual, but probably perennial, extensively creeping and rooting but with ascending branches, greenish or grayish: lvs. opposite, cuneate-spatulate to oblanceolate, nearly or quite sessile, tapering to a long entire base, serrate above the middle: heads ovoid and becoming nearly cylindrical, on filiform peduncles that exceed the lvs., the bracts obovate or irregularly cuneate, acuminate and sometimes mucronate; fls. rose-purple to nearly white, the corolla short; calyx thin in texture, equaling corolla, unevenly cleft on the two sides, the teeth lanceolate; bracts of fl.-head about as long as corolla-tube, with glabrous or nearly glabrous hyaline margins. Sandy soil, Ga., south (in the tropics widely distributed); in Calif. prominent on river banks, and, according to Jepson, esteemed for holding levees against erosion. L. H. B.

LIQUIDÁMBAR (from Latin *liquidus*, fluid, and the Arabic *ambar*, amber; in allusion to the fragrant juice which exudes from the tree). *Hamamelidaceæ*. Ornamental trees grown chiefly for their handsome foliage assuming crimson tints in autumn.

Deciduous: lvs. alternate, slender-petioled, palmately 3-7-lobed, serrate, with small stipules; fls. apetalous, usually monœcious, in globular heads; staminate fls. without perianth, intermixed with small scales, in heads forming a terminal raceme; pistillate fls. in slender-peduncled globular heads consisting of more or less cohering 2-celled and 2-beaked ovaries subtended by minute scales in place of calyx-lobes: fruiting head globose, spiny from the persistent styles, consisting of dehiscent caps., each with 1 or 2 winged seeds.—About 4 species in N. and Cent. Amer. and in W. and E. Asia. *L. orientalis* yields the liquid storax; the resin of *L. Styraciflua* is used in the preparation of chewing-gum.

Only *L. Styraciflua* is well known in cultivation; it is a beautiful pyramidal tree of very symmetrical habit with maple-like lustrous leaves assuming a deep crimson color in autumn; in winter it is conspicuous from



2182. Liquidambar *Styraciflua*. (× $\frac{1}{2}$)

its usually corky branches, the persistent pendulous fruit-heads and the deeply furrowed bark. It is hardy as far north as Massachusetts; it is of moderate growth and prefers moist situations. It is free from insects and diseases and is said to withstand salt air. It requires close pruning when transplanted. Propagation is by seeds which should be stratified as soon as ripe; many of them do not germinate until the second year.

Styraciflua, Linn. SWEET GUM. BILSTED. ALLIGATOR TREE. Fig. 2182. Tree, 60-140 ft. high: lvs. 5-7-lobed, with acuminate, finely serrate lobes, lustrous and dark green above, paler below and glabrous except large tufts of pale rufous hairs in the axils of the principal veins, 3-7 in. across; petioles 5-6 in. long; fr. 1-1½ in. across. March-May. Conn. and S. N. Y. to Fla., Ill., Mo. and Mex. S.S. 5:199. G.F. 2:235. P.G. 3:111. G.C. II. 14:633. Mn. 4:117. Gn. 24, pp. 166, 167; 38, p. 208. F.S.R. 3, p. 85. F.E. 18, p. 90.

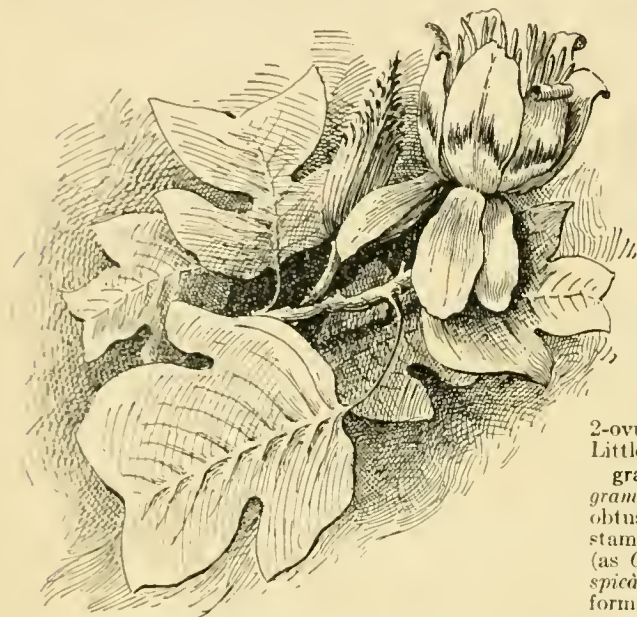
L. formosana, Hance. Tree, to 120 ft.: lvs. usually 3-lobed, pubescent on young plants, glabrous on older trees and only slightly hairy in the axils; scales subtending the ovary subulate, becoming spiny in fr. S.E. to Cent. China. H.I. 11:1020. Var. *monticola*, Rehd. & Wilson. Lvs. always glabrous. Hardier than the type. Cent. China.—*L. orientalis*, Mill. (*L. imberbe*, Ait.). Lvs. usually 5-lobed, the lobes usually with 2-4 small lobes, quite glabrous, smaller than in *L. Styraciflua*. W. Asia. H.I. 11:1019. F.S.R. 3, p. 87. Somewhat less hardy than *L. Styraciflua*.

LIQUORICE: *Glycyrrhiza*.

ALFRED REHDER.

LIRIODENDRON (*lirion*, lily, and *dendron*, tree; referring to the shape of the flowers). *Magnoliaceæ*. **TULIP TREE**. **WHITEWOOD**. **YELLOW POPLAR**. Ornamental trees grown for their handsome foliage and large tulip-like flowers.

Deciduous: lvs. alternate, long-petioled, 2-6-lobed, with conspicuous deciduous stipules cohering when young and inclosing the next lf.; fls. terminal, solitary, with 3 spreading sepals and 6 erect, broadly ovate petals; stamens numerous, with long and linear anthers; pistils numerous, forming a narrow column, developing into a light brown cone; at maturity the carpels, each consisting of a long, narrow wing with a 1-2-seeded nutlet at the base, separate from the slender spindle.—Two species in N. Amer. and China.



2183. Tulip tree.—*Liriodendron Tulipifera*. ($\times \frac{1}{2}$)

Only the native species, one of the noblest trees of the American forest, is well known in cultivation. It is a hardy beautiful tree of pyramidal habit, well adapted for park-planting and for avenues, with handsome, clean foliage of unusual shape and of rather light bluish green color, rarely attacked by insects or fungi, assuming in fall a brilliant yellow color; the tulip-like flowers, though of not very showy color are conspicuous by their size and shape. The tulip tree is also an important forest tree, and the soft, fine-grained, light yellow wood is much used in carpentry for furniture, boat-building and the manufacture of small articles; it does not split easily but is readily worked and bent to any required shape. The inner bark is said to have medical properties. The tulip tree grows best in deep, rich and somewhat moist soil. Transplanting is not easy; it is best done in spring, just before the tree starts into new growth. Propagate by seeds sown in fall or stratified and sown in spring; varieties are usually grafted or budded on seedling stock, rarely propagated by layers. The seeds are sometimes hollow, especially those grown along the eastern limit of the species.

Tulipifera, Linn. Fig. 2183. Tall tree, to 150, rarely to 190 ft., with a trunk to 10 ft. diam., often destitute of branches for a considerable height, glabrous: lvs. about as broad as long, with 2 lobes at the truncate and notched apex and 2-4 lobes at the base, bluish green above, pale or glaucous beneath, 5-6 in. long; fls. greenish yellow, marked orange within at the base,

1½-2 in. long; petals ovate or oval; fertile carpels acute. May, June. Mass. to Wis., south to Fla. and Miss. S.S. 1:13. Em. 2:605. B.M. 275. Gng. 7:259. A.G. 1892:485. Mn. 2, p. 4; 6, p. 145. Gn. 34, p. 42; 76, p. 646. F.S.R. 2, pp. 5, 7; 3, p. 203. G.C. III. 55:255. V. 20:86. Var. *pyramidale*, Lav. (var. *foetigiatum*, Hort.). With upright branches, forming a narrow pyramid. Var. *integrifolium*, Kirchn. Lvs. rounded at the base without lobes. Var. *obtusifolium*, Pursh. Lvs. with only 1 rounded lobe on each side of the base. Var. *contortum*, Goesehke. Lvs. with 2 lobes on each side, twisted so that the upper lobes often form a right angle to the lower ones. There are also several vars. with variegated lvs., of which var. *aureo-marginatum*, Hort. (var. *panaché*, Hort.), with lvs. edged yellow, is one of the best. F.S. 19:2025; 20:2081.—In the Middle West, *liriodendron* is universally known as whitewood. To lumbermen in the East it is known as poplar and tulip poplar.

L. chinense, Sarg. (*L. Tulipifera* var. *chinense*, Hemsli.) Tree, to 50 ft.: lvs. with 4 acute or acuminate lobes, rounded or slightly cordate at the base, 5-6 in. long; fls. 1-1½ in. long; cone slender, the fertile carpels obtuse or obtusish at the apex. Cent. China. G.C. III. 34:370; 44:429. S.T.S. 1:52. H. I. 28:2785.—Seems somewhat tenderer than the native species. ALFRED REIDER.

LIRIOPE (named after the nymph Liriope). *Liliaceæ*. A tender violet-flowered cultivated plant from China and Japan.

Plants of somewhat doubtful affinity, having been referred to different families: rhizome short and thick, often stoloniferous; st. very short, the lvs. narrow and crowded, the fls. on simple scapes, small, violet or whitish; segms. distinct; stamens 6, hypogynous; ovary 3-celled, each cell 2-ovuled.—Species about 3, China, Japan, Philippines. Little cult.

graminifolia, Baker (*L. spicata*, Lour. *Dracæna graminifolia*, Linn.). Lvs. all radical, linear-lanceolate, obtuse, 3-nerved, with a few brown scales at the base; stamens 6; style columnar; ovary 3-celled. B.R. 593, (as *Ophiopogon spicatus*). Var. *densiflora*, Hort. (*L. spicata* var. *densiflora*, Wright) is presumably the best form. B.M. 5348 (as *Ophiopogon spicatus*). There are several forms of this species, as: Var. *minor* (*L. spicata* var. *minor*, Wright). L.B.C. 7:694 (as *Ophiopogon spicatus*); var. *koreana* (Wright); var. *intermedia* (Maxim.).—*L. graminifolia* should perhaps be grown in the greenhouse. It is 1 ft. or more high, with grass-like foliage and 1 or 2 scapes overtopping the lvs., which bear from July to Sept. as many as 90 violet-colored fls. in a spike-like raceme 6-12 in. long and 1 in. wide. The fls. are less than ½ in. across, 6-parted and arranged in groups of 3-5 along the raceme. They vary from dark purple through violet to whitish. The deepest color is the finest, and is set off by the yellow anthers.

WILHELM MILLER.

L. H. B.†

LISIANTHUS (Greek compound). *Gentianaceæ*. About 10 species in the W. Indies and Cent. Amer., herbs or shrubs with mostly rather large yellow-green, brown-black or rarely white fls. in cymose clusters, and opposite lvs. None of the species seems to be in the trade, although *L. Russellianus*, Hook. (*L. erythronæsis*, Hort.), is recorded as a cult. plant in garden literature; this plant is *Eustoma Russellianum*, Griseb., growing on plains Neb. to La. and Mex. Glaucous: st. simple, or with a few opposite branches: lvs. opposite, connate, ovate or ovate-oblong, 3-5-nerved; fls. panicled, as large as a tulip; lobes obovate, spreading; stigma of 2 very large, green, velvety, spreading plates; pod oblong; seeds minute, pale brown. B.M. 3626. G.C. III. 4:240. R.H. 1863:51; 1881, p. 189. G.M. 49:479. Gn. 70, p. 77. G. 25:292. G.W. 11, p. 138. H.F. II. 4:240. It is a tender annual and grows 1½



LXVI. The tulip tree.—*Liriodendron Tulipifera*.

ft. high, producing its 5-lobed, purple, dark-eyed fls. in summer and fall. Under favorable conditions the fls. are 4 in. across, as many as 10 or 11 on a plant, and individual blossoms have been known to last three weeks. According to F. L. Harris, in the Old World it is usually treated as a cool greenhouse subject, being sown in early spring for summer and autumn bloom. The seed should be sown carefully, and at every stage of the plant's growth over-watering should be guarded against. The seedlings are very likely to damp-off. When they are ready for transplanting from the seedbeds, use small pots. When larger plants are needed, place them in a light, airy place and give generous bottom heat. For soil, use good loam, sand and well-rotted manure.

WILHELM MILLER.

LISSOCHILUS (Greek, *smooth lip*). *Orchidaceæ*. Terrestrial herbs, some of which are very handsome, but they seem to be little cultivated in America, only a single species being advertised here.

The plants are distinguished from their near allies by the dissimilarity of the sepals and petals, the latter being much larger and wider and usually of a different color: lvs. plicate and prominently veined, long and narrow; sts. very short, leafy, finally thickened into pseudobulbs: raceme simple; scape long, stout, sheathed but leafless, growing beside the pseudobulb; labellum spurred or saccate, joined to the base of the column.—About 30 species dispersed in Trop. and S. Afr.

The plants may be grown in a compost of fibrous loam, leaf-mold and sand. During the growing season they require plenty of water, but during three months of winter they should be allowed to rest and be kept dry.

Krébsii, A. Rich. Lvs. in tufts on the young sts. elliptic-lanceolate, 8-12 in. long; scape 2-3 ft. high; raceme 12-18 in. long, with 20-30 fls.; sepals linear-oblong, bent back, green, with dull purple blotches; petals much larger, golden yellow; lip yellow, pendulous, saccate between the small, rounded lateral lobes; middle lobe orbicular, notched in front. Flowers from May to Oct., the fls. remaining a long time. Natal. B.M. 5861.

L. Anderssonii, Rolfe. Racemes loose, 4-8-fld.; sepals and petals pale greenish or sulfur-yellow; lip white. Trop. Afr.—*L. giganteus*, Welw. & Reicheb. f. A gigantic orchid whose lvs. are said to grow to a length of 8 ft., with fl.-spikes twice as high; sepals linear, curled backward; petals oblong-quadrate, 1½ in. across, pinkish rose; labellum 3 in. long, with a long spur; middle lobe trowel-shaped, purple, striped with darker lines. Congo. G.C. III. 3:617. S.H. 2:355. I.H. 35:53. J.H. III. 55:52.—*L. Gratioti*, Reicheb. f. Raceme about 6-fld.; sepals brownish green; petals bright yellow behind, paler in front; lip light yellow. E. Afr.—*L. Horsfallii*, Batem. A robust plant, with plicate lvs. 2-3 ft. long and 5-6 in. broad, sharp-pointed; fl.-stalk twice the length of the lvs., with many large fls. 3 in. diam.; sepals reflexed, rich purple-brown on the upper side; petals much larger, almost square, white, suffused with rose. B.M. 5486. G.C. III. 39:200. G.M. 49:193. C.O. I. Handsomer than the first.—*L. Mahonii*, Rolfe. Raceme stout, many-fld.; fls. large; sepals reflexed, green, suffused and veined with brown; petals rose-lilac; lip 3-lobed, the lateral erect lobes green, crenulate, brown-nerved, the front lobe spreading, retuse crenulate, the front purple, darker nerved, green at base; keels denticulate, undulate, greenish. Uganda. B.M. 5047.—*L. purpuratus*, Lindl. Sepals and petals rose-pink, narrowly oblong; middle lobe of lip purple, ovate-oblong. Trop. Afr. B.M. 7921.—*L. roseus*, Lindl. Lvs. broad and stiff; at 3-4 ft. high; sepals brown; petals and labellum fine rose-colored. B.R. 30:12. Also a showy plant.—*L. speciosus*, R. Br. Pseudobulbs nearly underground; lvs. dark green, ensiform; scape 2-4 ft. high, with fragrant fls. 2 in. across; sepals small, green, reflexed; petals large, yellow; lip mostly yellow, apparently on the upper side, due to the inversion of the fls. June, July. Cape. B.R. 573 (erroneously numbered 578). P.M. 4:25.—*L. stylites*, Reicheb. f. Fls. purple; sepals reflexed, pale green, tinged lilac at base; petals nearly erect, pale purple, nearly orbicular; lip pandurate, pale purple; base widely pouched, white outside, pale green inside and brown-dotted. Trop. Afr. B.M. 8397.—*L. ugandæ*, Rolfe. Fls. numerous, yellow, marked with purple-brown at apex of sepals and petals; lip with front lobe oblong-orbicular, reflexed. Uganda. B.M. 5044.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

LISTÈRA (after Martin Lister, 1638(?)–1712). *Orchidaceæ*. Small orchids, sometimes transferred to cultivated areas.

Small, slender, erect herbs, with fibrous or sometimes fleshy roots, bearing a pair of opposite green lvs. near the middle, and 1 or 2 scales near the base of the st.: fls. small, spurless, in a terminal raceme; sepals and petals similar, spreading or reflexed; labellum rather longer, narrow, entire or 2-lobed.—About 10 species, natives of the North Temperate Zone.

convallarioides, Torr. St. 4-10 in. high, with smooth, round-oval, obtuse, cuspidate lvs.: raceme 2-3 in. long, bearing 3-12 greenish yellow fls. June-Aug. In woods, Nova Scotia to Alaska and Calif.; south to N. C. in the mountains. B.B. 1:473.

cordata, R. Br. Very slender, 3-10 in. high: lvs. cordate-ovate, mucronate: raceme 1-2 in. long, with 4-20 minute purplish fls. June-Aug. In moist woods, Nova Scotia to Alaska and Ore., south to N. J.; Eu. B.B. 1:473.

HEINRICH HASSELBRING.

LISTRÓSTACHYS (Greek, *shovel* or *hoe*, and *spike*). *Orchidaceæ*. Orchids with the habit of *Angræcum*.

Racemes many-fld.; sepals and petals alike, spreading; lip adnate to the foot of the column, with a long thin or reflexed spur; column bent back against the dorsal sepal; pollinia 2, upon divided stalks.—About 60 species, in Trop. Afr.

pertusa, Reicheb. f. (*Angræcum pertusum*, Lindl. A. *Pescatorcanum*, Lindl.). Sts. up to 1 ft. tall: lvs. narrowly strap-shaped, obliquely 2-lobed: fls. covering peduncle nearly to the base, about 1½ in. across, white, on the upper side; sepals and petals ovate; lip obovate-spatulate; spur slender, greenish. Bourbon. B.M. 4782.

L. bidens, Rolfe. Free-flowering epiphytal orchid from W. Trop. Afr.; sts. elongated, many-lvd.; lvs. thick, ovate-oblong, obliquely 2-lobed: fls. fragrant, many, in slender hanging racemes, white or pinkish, the spur as long as the lip. B.M. 8014.—*L. bracteosa*, Rolfe. St. very short: racemes axillary, few-fld.; fls. pale yellowish green, fleshy. Mauritius.—*L. caudata*, Reicheb. f. (*Angræcum caudatum*, Lindl.). Racemes zigzag, 5- or more-fld.; fls. distant, about 3 in. across; sepals and petals linear-lanceolate, olive-green, flushed with pale brown; lip clawed, obovate-cuneate; spur pale brown, 8-9 in. long. Sierra Leone. B.R. 1844. O.R. 20:297. B.M. 4370.—*L. Chailluana*, Reicheb. f. (*Angræcum Chailluianum*, Hook. f.). Lvs. up to 8 in. long, 1½ in. broad: racemes 6-10-fld.; fls. milk-white; spur slender, flexuous, greenish. W. Afr. B.M. 5589. J.H. III. 43:579. G.C. III. 31: suppl. March 22.—*L. dactyloceus*, Reicheb. f. About 3 in. high: lvs. very fleshy, sword-shaped: fls. white. W. Trop. Afr.—*L. fimbriata*, Rolfe. Fls. translucent white, with slight greenish tinge; spur long and slender. Uganda. Afr.—*L. hamata*, Rolfe. Remarkable for having all the long spurs hooked at the tip; fls. white, with green spur. W. Trop. Afr. B.M. 8074.—*L. imbricata*, Rolfe. Plant very small: spike about 7-fld.; fls. white, small. Trop. Afr.—*L. Kindiana*, Wildem. Dwarf: racemes short, dense; fls. yellow, star-shaped. Congo.—*L. Monteiroi*, Reicheb. f. (*Angræcum aeternatum*, Kränzl.). Robust epiphyte from W. Trop. Afr., sometimes met with in cult.: 1-2 ft., bearing roots toward the base: lvs. oblong or obovate-oblong, obliquely bilobed: racemes erect, many-fld., 6-12 in. long; fls. yellowish white, the upper part of spur ochreous and the base light green. B.M. 8026.—*L. pellucida*, Reicheb. f. (*Angræcum pellucidum*, Lindl.). Racemes pendulous, many-fld.; fls. semi-transparent, spiral, yellowish white; lip cordate, truncate at apex, fimbriate; spur short. Sierra Leone. G.C. III. 49:18. C.O. I. R.B. 32, p. 38.—*L. vandaeformis*, Kränzl. Plant very large: racemes nodding, many-fld.; fls. yellow. W. Trop. Afr. G.W. 13, p. 54.—*L. Whitei*, Rolfe. Racemes several-fld.; fls. small, sweet-scented, white, wax-like, with pointed brown-tipped spurs. Uganda. GEORGE V. NASH.

LITCHI (Chinese name). *Sapindaceæ*. One species in China, and cultivated elsewhere for its edible fruit.

By some botanists included in *Nephelium*, but the definition is probably clearer if *Litchi* and *Euphoria* are kept distinct, both of which differ from *Nephelium* in having the seed-covering or arillus free from the seed rather than grown to it.

chinensis, Sonn. (*Septalia chinensis*, Gaertn. *Dimocarpus Litchi*, Lour. *Nephelium Litchi*, Camb.). *LITCHI* or *LEECHEE*. Fig. 2184. Lfts. 2-4 pairs, elliptic-oblong to lanceolate, glabrous, lustrous above, glaucescent beneath. China. A.G. 12:269.—Not to be confounded with the longyen (see *Euphoria*) or the rambutan (see *Nephelium*).

L. H. B.

Culture of the litchi.

Of the numerous fruits cultivated in south China, the litchi (*Litchi chinensis*) is one of the most highly esteemed, both by natives and Europeans. It is considered indigenous to the region, but has been in cultivation since a remote day, and lends itself to a wider variety of uses than many other tropical fruits. As a dried fruit it is well known, and is shipped to the United States and other occidental countries, while a

2184. Litchi. ($\times \frac{3}{4}$)

considerable quantity is preserved in syrup and exported. Like most other fruits, however, it is considered most delicious when fresh.

Its cultivation is not limited to south China and the adjoining regions. In parts of India it is very well known, especially in the section north of Calcutta, while it is also grown to a limited extent in northeastern Australia, Formosa, southern Japan, Hawaii, the West Indies, Brazil, and other regions. It is said to have been introduced to Florida in 1886, but, so far as known, has not yet fruited in that state, although in certain sections the climate and soil seem well adapted to its culture. It bloomed at Tampa in 1914 and 1915, but the trees were young and failed to carry any of their fruit to maturity. In California it has been grown successfully only in the most protected locations. The first fruits ripened in that state were produced at Santa Barbara in 1914. The litchi is quite susceptible to frost when young, but mature trees will withstand several degrees of freezing without permanent injury.

The litchi is a small to medium-sized tree, usually spreading in habit, with a dense head of bright green foliage. The leaves are compound, with two or three pairs of elliptical to lanceolate leaflets 2 to 3 inches in length. In India it is said to flower in February, in China during April, ripening its fruits about the first of May in the one case and during July in the other. The flowers are small and inconspicuous, but are produced in great abundance in terminal panicles.

The fruits, which are borne in loose clusters of two or three to twenty or even more, have been likened to large strawberries in appearance. In shape they are oval to ovate, in diameter $1\frac{1}{2}$ inches in the better varieties, and in color deep rose when fully ripe, changing to dull brown as the fruit dries. The outer covering is hard and brittle, rough on the surface and divided into small scale-like areas, from which short conical protuberances usually arise. The seed is small and shrivelled in the grafted varieties, but in seedlings is as large as a good-sized castor bean; surrounding it, and separating from it readily, is the edible part, in reality the aril, which is translucent, whitish, juicy, and of firm texture. In flavor it is subacid, strongly suggestive of the Royal Ann cherry, especially when cooked. Firminger says it is "as delicious, perhaps, as that of any fruit in existence." The fruit is dried just as it comes from the tree, the aril shrinking away from the thin outer shell and remaining as a rather tough layer around the seed. In this form the litchi is occasionally seen on fruit-stands of American cities; the flavor bears little resemblance to that of the fresh fruit, having been likened to that of raisins.

In China the litchi is said to succeed best when planted on deep rich soil near the bank of an irrigating-canal. A soil rich in humus is by far the best, and there should be an abundance of water for irrigating purposes. From the fact that the tree does well in parts of northern India where the rainfall is not more than 40 inches per annum, it does not appear that a very humid atmosphere is necessary, provided there is ample water for irrigation. The trees should be set about 25 feet apart, and require very little pruning. It is sometimes necessary to thin the young fruits, leaving no more in a cluster than the tree can properly mature; this results in larger and finer fruit. Seedlings do not come into bearing until seven to nine years of age, but trees propagated by layering or grafting usually commence to bear at three to five years. Fertilizing is said to be extensively practised by the Chinese, an application of liquid manure being given once in every three or four months.

The gootee method of propagation, as it is known in the Orient, is the method most commonly employed by the Chinese, and is used in India as well. A healthy, well-matured branch is chosen, and a narrow ring of bark removed just below a leaf-bud or node. Around this is formed a ball of clay soil, with an outer covering of coconut fiber, tow, or moss, to hold it together. A little above the ball a good-sized flower-pot or earthen vessel is suspended, and a piece of soft rope is inserted through the small hole in the bottom. The rope should fit the hole snugly, and is knotted on the inside; it is then carried to the gootee, and wound around the ball several times. The water trickles from the pot, which should be filled every day or two, and after running slowly down the rope is distributed over the gootee, keeping it uniformly moist. The gootee is made in spring, from February to April, depending upon climatic conditions, and at least three or four months are required for roots to form. When the ball is filled with roots and they begin to show on the surface, the branch is severed from the tree and planted in its permanent location in the orchard.

In India, layering is often practised, the outer ends of branches being laid across flats of soil suspended upon a light framework of poles. After a notch is made in the under side of the branch, it is covered with soil for a distance of several inches, and kept moist by frequent waterings. Inarching is also practised, the method being the same as for the mango. Seedling litchis are generally used for stocks. The litchi can be grafted on its near relative the longan (*Euphoria Longana*), but it takes a longer time to effect a union, and it is believed that the tree grows more slowly than when on litchi stock.

The amount of variation among seedling litchis is considerable; hence the best varieties can be propagated only by some vegetative means, though seedlings are often grown. Grafting and layering have not only the advantage of reproducing a known variety, but trees so propagated come into bearing several years earlier than seedlings. Seeds should be sown as soon as possible after their removal from the fruit, as they do not long retain their vitality.

The Chinese cultivate several named varieties, and there are at least eight known in India, of which the best are said to be McLean's and Bedana ("seedless"), the latter having a very small stone which is usually sterile. Firminger mentions one variety in India which is green in color and of a distinct and very sweet flavor.

F. W. POPEOE.

LITHOSPERMUM (Greek, *stone seed*; the seeds like little stones). *Boraginææ*. GROMWELL. PUCCOON. Low-growing hardy mostly herbaceous perennials of minor importance, some of them attractive as alpine and in rock-gardens.

Lithospermum has fifty species in extra-tropical regions around the globe, mostly in the northern hemisphere: herbs or subshrubs, rough, silky, or bristly: lvs. alternate, sessile and entire: fls. white, yellow, bluish or violet, in leafy often curved racemes or spikes, sometimes dimorphous as to stamens and style; calyx 5-parted; corolla funnel- or salver-shaped, 5-lobed, the tube cylindrical and straight, the throat naked or crested; stamens 5, fixed to the tube; ovary 4-lobed, with a slender style, stigma usually capitate or 2-lobed; plants mostly with red roots. The genus is closely allied to *Moltkia*, which see.

In cultivation, the best known is *L. fruticosum*, a rock-garden trailer, which bears numerous leafy spikes of blue flowers, each about $\frac{1}{2}$ inch across, from early summer to autumn. *L. purpureo-caruleum* is also an old garden plant. The common growwell, *L. officinale*, is rarely cultivated as a medicinal herb. Others are procurable from dealers in native plants. Seeds of the growwell and the western species are procurable, and plants of the other kinds from dealers in rock-garden plants. *L. fruticosum* is said to be propagated only by cuttings of the previous year's wood; *L. multiflorum* by cuttings of young shoots. The kinds with red roots yield a dye. *L. arvense* is an annual or biennial introduced weed; but most of the species (and those cultivated) are perennial. The best known garden kinds are European, but the American species are deserving of greater attention.

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A. Color of fls. dull white.

1. *officinale*, Linn. GROMWELL. Much branched, 2-3 ft. high: lvs. lanceolate or ovate-lanceolate, 2 in. or less long: infl. sparse; throat of corolla crested with appendages; fls. dull white, small; tube about as long as the calyx. Along N. E. roadsides, naturalized from Eu. .

AA. Color of fls. yellow or orange.

B. Corolla-tube scarcely, if any, exceeding the calyx.

2. *pilosum*, Nutt. Mostly unbranched, 1 ft. high: lvs. linear and linear-lanceolate, 2-4 in. long: fls. dull greenish yellow, crowded in a leafy thyrse; throat of corolla nearly devoid of appendages. W. N. Amer.

BB. Corolla-tube much longer than the calyx: roots red, long and deep: fls. large, showy. (Puccoons.)

C. Floral lvs. reduced to bracts no longer than the calyx.

3. *multiflorum*, Torr. Height 1-2 ft., often paniculate-branched at summit: lvs. linear to linear-lanceolate: fls. numerous, short-pedicelled and sometimes spicate, the corolla about $\frac{1}{2}$ in. long and with short rounded lobes, light yellow. Rocky Mts. to W. Texas.

CC. Floral lvs. much longer than the calyx.

D. Crests of throat little if at all projecting or arching.

4. *canescens*, Lehm. PUCCOON, of the Indians. RED-ROOT. INDIAN PAINT. Fig. 2185. Height 9-12 in. or more: lvs. oblong-linear or the upper ones broader, mostly silky pubescent and obtuse: fls. orange, the limb large and crests in throat prominent although not projecting: fls. nearly without pedicels. Plains and open woods, in sandy soil. Ont. to Ala., west to Ariz. B.M. 4389. G.M. 44:337.

5. *Gmelinii*, Hitchc. (*L. hirtum*, Lehm.). Height 1-2 ft.: lvs. lanceolate or the lower ones narrower: fls. bright orange, mostly pedicelled; glandular ring at base within bearing 10 very hirsute lobes or teeth. Pine barrens, Mich. to Fla. and Colo.

DN. Crests of throat conspicuous and arching: fls. mostly very long and showy, often of two kinds.

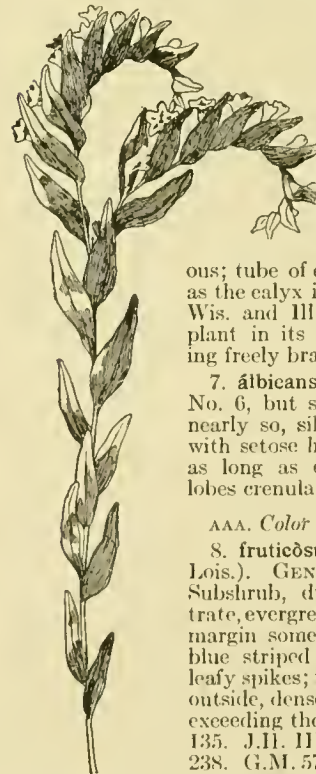
6. *angustifolium*, Michx. (*L. linearifolium*, Goldie).

Height 9-12 in. or more: lvs. all linear: fls. of 2 sorts, the earlier and conspicuous kind bright yellow, with corolla-tube 1 in. or so long, later ones and those of the more diffusely branching plants with inconspicuous pale corolla, without crests in the throat and probably clistogenous; tube of corolla 2-4 times as long as the calyx in the large fls. Dry soil, Wis. and Ill., W. and S.—A showy plant in its large-fl. stage; becoming freely branched.

7. *albicans*, Greene. Related to No. 6, but sts. fewer and simple or nearly so, silvery-hoary: lvs. linear, with setose hairs: corolla only twice as long as calyx, deep yellow, the lobes crenulate. S. Colo.

AAA. Color of fls. blue or purplish.

8. *fruticosum*, Linn. (*L. prostratum*, Lois.). GENTIAN-BLUE GROMWELL. Subshrub, dwarf, trailing or prostrate, evergreen: lvs. lanceolate-linear, margin somewhat revolute: fls. deep blue striped red-violet, in terminal leafy spikes; tube of corolla pubescent outside, densely villous at apex, much exceeding the calyx. S. Eu. Gn. 45, p. 135. J.H. III. 32:475. G.C. III. 30:238. G.M. 57:455. G. 36:619. H.U. II. 7:38.—Correvoyn states that *L. prostratum*, which comes from the W. Pyrenees, is different from *L. fruticosum*.



2185. Puccoon—*Lithospermum canescens*. ($\times \frac{1}{2}$)

sum; it is a low running species rather than erect-growing (as he defines *L. fruticosum* to be), covering the soil, and the lvs. are more lanceolate, shorter, broader, and reflexed at the edges; it is destroyed by limestone, which is not the case with *L. fruticosum*.

9. *purpureo-cæruleum*, Linn. Sts. leafy and procumbent, reaching 2 ft. or more long, the fl.-sts. ascending or nearly erect and bearing leafy forked cymes: lvs. lanceolate, hairy: fls. rather large, rich blue, nearly sessile, usually surpassed by the lvs. Eu.

10. *Gastonii*, Benth. Beautiful plant, rare in the Pyrenees: a dwarf leafy perennial, adapted to alpine gardens, appressed-hairy, the erect branches 4-10 in. high: lvs. to 3 in. long, spreading and recurved, ovate-lanceolate, taper-pointed: fls. few, deep blue with star-like white eye, crowded near tips of branches; corolla-tube short, the lobes broadly ovate, the throat pubescent; calyx-lobes lanceolate, acute. B.M. 5926. G.C. III. 47:212.—Said to like lime.

11. *Zöllingeri*, A. DC. Perennial, with ascending sts., 4-6 in., silky-hairy: lvs. oval-oblong, usually mucronate, attenuate at base: fls. few, probably purple, the corolla nearly $\frac{1}{2}$ in. long; corolla-tube cylindrical-funneliform, twice longer than calyx; lobes of calyx linear, pilose. Java, but not since found there according to Koorders.—The plant in the trade under this name is said to make tufts of very rough glistening foliage, with sky-blue fls.: adapted to front-row of borders and large rockeries (in England).

The garden names of *Lithospermum* are confused and need to be re-studied. *L. caelestinum*, Hort., is described as "a most desirable low-growing plant for the rockery," with pretty blue fls. in June. Probably *Moltkia carulea*.—*L. Froëbellii*, Hort., is said to be "a dwarf compact plant with rosemary-like lvs. and deep blue fls. on erect sts. about 9 in. high."—*L. graminifolium*, Viv.=*Moltkia graminifolia*.—*L. intermedium*, Hort., is "a pretty dwarf shrubby plant with pale blue fls."—*L. intermedium*, Hort., perhaps the same as the last, is "a pretty dwarf shrubby species, with fls. a lovely shade of blue." Somewhat shrubby, 8-10 in. high: lvs. narrow and slightly hoary: fls. tubular, drooping. G. 34:887. Probably these are *Moltkias*.—*L. petraeum*, A. DC.=*Moltkia*.—*L. rosmarinifolium*, Tenore. Evergreen, from Italy and Greece, 1-2 ft. lvs. narrow, 1 in. or more long: fls. bright blue, striped white about $\frac{3}{4}$ in. diam. Gn.W. 22:139.

L. H. B.†

LITHRÆA (*Lithi*, the Chilean name of *L. caustica*). *Anacardiaceæ*. Three species of evergreen S. American shrubs or small trees closely related to *Schinus*: lvs. alternate, simple or odd-pinnate: fls. small, greenish or whitish, in panicles; petals 5, valvate, stamens 10; disk annular in the staminate fls., cup-shaped and 10-lobed in the pistillate fls.; ovary superior, 1-celled with a basal, sessile ovule: fr. a dry subglobose drupe with a hard bony stone. The following species is occasionally cult. in S. Calif. *L. molleoides*, Engler (*L. Aroeirinha*, March.). Shrub, to 12 ft., glabrous: lvs. odd-pinnate; lfts. 5, rarely 3, lanceolate, acute, $1\frac{1}{2}$ -3 in. long; petiole $1\frac{1}{2}$ in. long, like the rachis narrow-winged: panicles 2-3 in. long: fr. globose, $\frac{1}{2}$ in. across, whitish, lustrous. S. Brazil, Argentina. Flor. Brasil. 12, 2:83. *L. caustica*, Miers, from Chile, has short-petioled simple, oval to ovate-oblong lvs. and pubescent panicles; it is said to be very poisonous. *L. Gillièsii*, Griseb. Tall shrub, 6-10 ft., the branches whitish gray, more or less dichotomous: lvs. 3-foliate or 5-foliate; lfts. lanceolate, the lower ones sessile, the upper narrowed below: fls. small, yellowish white, in few-fl. clusters: fr. a dry drupe. Brazil, Chile. R.H. 1914, p. 201.

ALFRED REHDER.

LITSEA (Japanese name). *Lauraceæ*. Trees or shrubs of little horticultural importance, but may be planted S. Lvs. mostly alternate, coriaceous, usually evergreen: fls. diœcious, small, clustered in umbel-like cymes, mostly white or yellow; perianth-tube very short or sometimes ovoid or bell-shaped, the lobes usually 4-6; stamens mostly 6-12: fr. a dry or succulent drupe, on the enlarged perianth-tube. Species perhaps 150 in warm and tropical countries well around

the globe, one of them (*L. geniculata*, Benth. & Hook.) growing in shallow ponds, Ga. to La. Adanson's name, *Malapœna*, is rejected by the Vienna or international rules.

LITTÆA: *Agave*.

LITTÔNIA (Dr. Samuel Litton, professor of botany in Dublin). *Liliaceæ*. One species is one of the so-called climbing lilies.

Tender, tuberous plants: fls. 6-parted, but in *Littonia* the segms. are not reflexed like a cyclamen, as in *Gloriosa* (which is another climbing lily), nodding, bell-shaped, orange or yellow, mostly 1 in. or more across; segms. oblong, acuminate; stamens 6, attached at base of perianth-segms.: caps. 3-celled; seeds scarlet or brown, about the size of a sweet pea, round, arranged in 2 series.—Species about 6, Arabia, S. Afr. and Trop. Afr.; most of them are erect not climbing herbs.

modesta, Hook. Slender and simple, either short and suberect or long and climbing or sarmentose: lvs. ovate to linear, produced into a tendril at the tip, the middle ones whorled and the upper ones opposite or alternate: fls. solitary in the upper axils, on slender pedicels; perianth-segms. provided with a small oblong nectary, partially closed by a ciliated scale on each side; style 3-cut. S. Afr. B.M. 4723. G.C. III. 36:183. Var. *Keitii*, Hort., is an improved form, with larger and more abundant fls., the sts. longer, branched, and distinctly sarmentose. These plants require the cultural treatment of *gloriosa*.

WILHELM MILLER.

L. H. B.†

LITTORÉLLA (from Latin word for *shore*, from place of growth). Sometimes spelled *Litorella*. *Plantaginaceæ*. Small aquatic grass-like plants, one in Eu. and the northern part of N. Amer., offered abroad among hardy water-plants, and one little known in southern S. Amer. Perennial, somewhat succulent, with linear lvs. from the base: fls. monœcious, borne among the lvs., not showy, the staminate on scapes and pistillate sessile at base of lvs.; sepals 4; corolla 3-4-toothed; stamens 4, long-exserted; ovary single, with a long-exserted style. *L. uniflora*, Aschers. (*L. lacustris*, Linn. *Plantago uniflora*, Linn.). Growing in mats on borders of ponds and lakes, the lvs. 2-3 in. long, linear-subulate, bright green; stoloniferous. Newfoundland and Nova Scotia to Maine, Vt. and Minn. L. H. B.

LIVE-FOREVER: *Sedum Telephium* and other *Sedums*.

LIVERLEAF: *Hepatica*.

LIVERWORT. A general name for a group of cryptogamia (flowerless plants), somewhat allied to mosses and known as *Hepaticæ*. *Conocephalus* and *Marchantia* have been offered by dealers in native plants as suitable for rockwork and bog-gardens. *Lunularia* is a common weed in greenhouses. See p. 6, Vol. I.

LIVING ROCK: *Ariocarpus*.

LIVISTONA (Patrick Murray, of Livistone or Livingsstone). *Palmaceæ*. The most extensively grown genus of fan-leaved palms in commercial horticulture of the present day, its commonest representative being the "Chinese fan palm," *L. chinensis*, which is also known to the trade, and improperly, as *Lantania borbonica*.

Trunks usually tall, stout, ringed below, clothed above with dead lf.-sheaths: lvs. spreading, orbicular, plicate, split to the middle or below; the segms. bifid, infolded, naked or fibrous along the margins; rachis short; ligule small, cordate, free; petiole long, stout, flat or rounded above, convex below, often spiny along the margins; sheaths margined with reticulate fibers: spadices long, at first ascending, pendent in fr., long-peduncled, loosely branched, the branches slender;

spathes many, long, tubular, compressed, sheathing the peduncle, thick, coriaceous, bifid or 2-lipped, 2-keeled or ancipital: no bracts or bractlets: fls. greenish: fr. smooth and shining, oblong-globose or ellipsoidal, black, blue, yellow or brown.—About 14 species from Trop. E. Asia, Malaya and Austral. From the seven allied genera mentioned under Licuala, Livistona is distinguished by the following characters: fls. hermaphrodite: carpels of the ovary globose, distinct or slightly cohering: styles short, distinct or cohering: albumen not twisted, broadly scooped out on the ventral side: branches of the spadices not bracted or the lower ones bracted. It is also remarkable in the group in having a thread in the lf-segms., at least in many of the species.

In general, the members of this genus are by no means difficult to grow, though it is well to make some distinctions in culture between such strong-growing and comparatively hardy palms as *L. chinensis* and *L. australis*, and the more tender species from Java and northern Australia, among which *L. humilis*, *L. olivæformis* and *L. rotundifolia* are prominent. For those of the first section a strong loamy soil well enriched with thoroughly decayed stable-manure, good drainage, an abundance of water and a night temperature of 60° will provide satisfactory conditions for sturdy growth. The more tropical species, of which *L. rotundifolia* is a good example, make better progress in a somewhat lighter soil and a higher temperature, 65° to 70° being more congenial to them than the cool treatment accorded their stronger relatives. More shade is also required for the warmhouse species, in order to retain the rich green color that a healthy livistona should present.—Red-spider and white scale are two of the most troublesome insects to the grower of livistonas, the first being controlled to a great extent by thorough syringing, while the latter may be eradicated by the careful use of various insecticides, though avoiding the frequent application of extract of tobacco, the continued use of the latter substance often resulting in injury to the foliage of livistonas.—*L. australis* is a more stubby-growing plant than *L. chinensis*, the fan-like leaves are stiffer and less graceful, and the footstalks are more thoroughly armed with stout spines, while the leaves are also smaller in proportion to the plant than those of *L. chinensis*. *L. Hoogendorpii* and *L. olivæformis* are somewhat alike in young plants, but the first has many more and coarser spines on the footstalks, and the stalks of *L. Hoogendorpii* are generally longer, the leaves of both being much divided. *L. rotundifolia* and *L. altissima* are much alike in a small state, and the writer is inclined to think that the seeds

of the latter are sometimes substituted for those of *L. rotundifolia*. The leaves of *L. rotundifolia* are flatter and more even in outline, those of *L. altissima* being somewhat undulated as though they were crowded on the stalk. In fact, small plants of *L. rotundifolia* are usually more symmetrical, and also have longer footstalks or petioles. (W. H. Taplin.)

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decipiens, 10.	Maria, 7.	Woodfordii, 2.

A. *Lvs. glaucous beneath.*

1. *Jenkinsiana*, Griff. Trunk 20–30 ft., about 6 in. diam.: lvs. 5–6 ft. broad, reniform, flabellate, 70–80-fid, glaucous beneath, the divisions very narrow, straight, shortly and obtusely 2-toothed: spadix 2–3 ft., the branches forked; fls. in tiny bunches, small and green: fr. bluish. Assam. G.W. 12, p. 208.—Perhaps not specifically distinct from *L. chinensis*.

AA. *Lvs. not glaucous beneath.*B. *Petioles without spines.*

2. *Woodfordii*, Ridley. Petioles slender, without thorns, only $\frac{1}{4}$ in. thick: lvs. orbicular, quite thin, 2 ft. long, 18 in. wide, split into very narrow acuminate lobes, the lower ones free almost to the base, the inner ones split only one-fourth of the way down: spadices very slender, the short slender branches protruding from the mouths of tubular brown sheaths: drupe globose, $\frac{3}{8}$ in. diam., bright red. Polynesia. First described in G. C. III. 23:177.—Nearly related to *L. australis*, but more graceful, with smaller fls. and fr.

BB. *Petioles spiny below the middle.*C. *Length of spines $\frac{1}{4}$ in. or less.*

3. *olivæformis*, Mart. (*Coriŷpha Gebanga*, Hort., in part). Sts. medium: lvs. glabrous; petiole somewhat 3-angled; spines retrorse, 1–3 lines long; segms. 12–15 in. long, deeply bilobed, the lobes very long, acuminate, linear, pendent, with or without very short filaments: fr. olive-shaped, solitary, or twin and connate to the middle. Brazil.

CC. *Length of spines 1 in. or more.*D. *Shape of lvs. reniform.*

4. *chinensis*, R. Br. (*Latania borbónica*, Hort., not Lam.). St. 6 ft. high, more than 1 ft. thick, gray, with approximate rings: lvs. many; petiole equaling the blade, covered to about the middle with retrorse brown spines, 1 in. or more long; blade reniform, 4–6 ft. diam.; segms. linear-lanceolate, long-pendulous, deeply forked, filiferous, the lower 1–2 ft. long, 1–2 in. wide, the middle 3 ft. long, the lobes acuminate, 4–8 in. long. China. G. 4:555. J.H. III. 48:185. Gn. M. 6:288. G.W. 10:202.

DD. *Shape of lvs. orbicular.*

5. *rotundifolia*, Mart. (*Chamærops Biroo*, Sieb. C. *Bjrrho*, Hort.). Trunk 40–50 ft. high, 1–1½ ft. diam., erect or rather weak, brownish black, obscurely ringed; petiole 6 ft., with recurved spines 1½ in. long at the base; blade 3–5 ft. diam., suborbicular, appearing, though not truly peltate; segms. 60–90, connate for one-third their length, bifid to the middle, the lobes long-acuminate. Java. R.B. 21, p. 110. F. R. 1:301. S.H. 2:28.

BBB. *Petioles spiny from base to apex.*C. *Segms. of lvs. free one-third of the way down.*

6. *altissima*, Zoll. Mostly stemless, or rarely a few feet of trunk: lvs. bright

2186. *Livistona humilis*.

shining green, 1½–2 ft. long; segms. free one-third of the way down, biid at the apex; petioles 2–6 ft., the base inclosed in a reddish brown network of woody fibers; spines stout, black, recurved. Java. A.F. 26:654.

cc. *Segms. free nearly to the base.*

d. *Position of segms. rigid, not drooping.*

7. *austrâlis*, Mart. (*Corypha australis*, R. Br.). Sts. 40–80 ft. high, slender, and marked with circular scars; lvs. in a dense crown, orbicular, 3–4 ft. diam., divided to or below the middle into 40–50 narrow, plicate, acuminate segms., either entire or 2-cleft at the apex. Austral. B.M. 6274. Gn. 26, p. 337. V. 9:328. G.C. III. 30:287.—A form in which the young petioles and lvs. are blood-red color, said to be wild in S. Austral., has been grown under the name. *L. Maria*, Muell.

dd. *Position of segms. drooping.*

e. *Number of segms. 10–12.*

8. *Hoëgendorpü*, Hort. St. tall, cylindrical, with triangular lf.-scars: petiole rounded on the back, 3–5 ft. long, red-brown at the base, olive-green above; spines stout, recurved, 1½–2½ in. apart, ¾–2½ in. long; lf. suborbicular, 4½–6 ft. diam.; segms. plicate, cuneate, pendulous at the apex and 5–7-lobed, the lobes acute. Java. I.H. 21:174. F.R. 1:427. Gn. 25, p. 392.

EE. *Number of segms. more than 12.*

9. *humilis*, R. Br. Fig. 2186 (redrawn from Martius). Sts. 4–16 ft. high; lvs. at length orbicular-cordate, 3 ft. diam., deeply divided; segms. narrow, plicate, acuminate, the filaments between the lobes altogether wanting or very minute or 1 in. long; petiole much flattened, with acute edges bordered with small prickles intermixed with larger ones, often ½ in. long. N. Austral. G.W. 12, p. 208.

10. *decipiens*, Becc. A medium-sized palm with a trunk diam. of about 15 in.; lvs. with about 80 segms., the latter much pendent at the tips; petiole very spiny at the base, long and stiff; lf.-segms. very weak, hanging as though wilted; spadix long, but nodding when in fr. S. Austral.—Little known in cult. but interesting on account of its “weeping” lvs. It is perhaps the *Copernicia cerifera* of some dealers.

11. *subglobösa*, Mart. A medium-sized palm: lvs. glabrous, the segms. 10–12 in. long, 2-parted nearly to the base, the lobes linear, very acuminate, pendulous: fr. subglobose, borne on a paniculate spadix about a foot long. Java.—Known in Java as “Sedangan.”

L. Dournoniäna, Hort., is “a new palm with lvs. resembling those of *Lantana borbonica*,” which is *Livistona chinensis*, Hab. (?) — *L. Muëlleri*, Bailey. A stout rugged palm about 20 ft.: lvs. densely crowded, the petiole about 3½ ft. long and covered with short curved prickles; fr. oval, nearly 6 in. long. Queensland, G.C. III. 32:431. Not in cult. in Amer.

N. TAYLOR.†

LLÁVEA (M. la Llave, who discovered the plant). *Polypodiææ*. One species, *L. cordifolia*, Lag., related to *Cryptogramma*, native to the highlands of Mex., little cult. It grows 2 ft. high or more, with tripinnate lvs. that have fertile segms. on the upper part: sori under the reflexed edges of the segms. It requires warmhouse treatment.

LLÓYDIA (after Edward Lloyd, who found one of the plants in Wales). *Liliææ*. Small bulbous plants related to *Erythronium*, but with leafy stem.

Bulb narrow: st. slender, low, usually 1–2-fl.: radical lvs. few, linear or nearly filiform; st.-lvs. few: fls. small, white or yellowish, long-lasting; perianth 6-parted; segms. withering and persistent; stamens 6, hypogynous, shorter than the perianth: caps. obovoid or subglobose; seeds flattish.—Species 5 or 6, mountains in N. Amer., Eu., Asia.

serótina, Sweet (*L. alpina*, Salisb. *Anthëricum serótinum*, Linn.). With an oblique, somewhat rhizomatous rootstock, and glands on the claws of the

perianth-segms.: radical lvs. 2–4, linear: st. usually 1-fl., 3–6 in. long: lvs. 3–4, small, linear: fls. whitish, yellowish purple at its base, erect. Mountains of Colo. and north to arctic regions and in Eu.—Attractive spring fl.; grows in high mountains.

L. H. B.

LOÛSA (South American name). *Loasææ*. Comprises a few flower-garden annuals of minor value.

Annuals and perennials, herbs or subshrubs, of Trop. Amer., erect or twining: lvs. alternate or opposite, entire, lobed or decompound; caps. 3–5-valved from the apex, rarely twisted; ovary 1-celled; ovules numerous. The allied genus *Blumenbachia* differs in having caps. longitudinally 5–10-valved and most frequently spirally twisted.—Species 80–100. These plants are too much like nettles to deserve general cult., although their fls. are odd and interesting. The pain from their prickles may last several days. Each of the 5-hooded petals contains a bunch of stamens. They are treated as half-hardy annuals. *L. lateritia*, Hook. (*L. aurantiaca*, Hort.), a climbing vine, is *Blumenbachia lateritia* (*Cajophora lateritia*, Klotzsch), which see under *Blumenbachia*. It is a hispid stinging twiner, with opposite pinnate lvs.: fls. bright orange-red, or brick-red: little grown, but adapted to indoor work and to the open in summer: prop. readily by seeds or cuttings. It is in the American trade as an annual climbing plant: 6–20 ft.

A. *Petals white.*

volcánica, André (*L. Wallisii*, Hort.). Erect, bushy annual, 2–3 ft. high: lvs. 3–6 in. broad, palmately 3–5-lobed, the lobes serrate, each with a long stalklet, the lateral ones often divided into 3 lfts.: sepals shorter than the petals; petals white; eye of fl. of 2 concentric red bands, with 5 yellow spots outside. Colombia. B.M. 6410. I.H. 25:302. R.H. 1894, p. 233.

AA. *Petals yellow.*

ûrens, Jacq. (*L. hispida*, Linn. f.). Annual, 1½ ft. high: lvs. alternate, 5 in. long, 3½ in. wide, pinnatifid; segms. lobed: fls. bright yellow, 1 in. across; sepals much shorter than the petals. June–Aug. Peru. B.M. 3057. G.C. III. 22:291. Gn. 25, p. 451.

tricolor, Lindl. Annual, 2 ft. high: lvs. opposite, bipinnatifid, very prickly: sepals as long as the petals; petals yellow; crown red; filaments white. Chile. B.R. 667.

L. H. B.

LOBËLIA (Matthias de Lobel, or L'Obel, 1538–1616, a Flemish botanist and author; Latinized *Lobelius*). Including *Tûpa*. *Campanulææ*. Excellent flower-garden and border plants, annual and perennial.

Mostly herbs, some tropical species somewhat woody: lvs. alternate, sometimes the cauline ones reduced to bracts: fls. blue, red or yellowish, on 1-fl. pedicels, which are arranged in a terminal raceme; corolla gamopetalous and tubular, split down one side; lobes 5, the 3 on the lower side (as the fl. stands) somewhat united and forming a lip, the other 2 (1 on either side of the cleft or split) erect or turned back; calyx short-tubular



2187. *Lobelia Erinus*.

or globular, joined to the ovary, short-toothed; stamens 5, united into a tube around the single style, the tube often protruding from the cleft into the corolla: fr. a 2-valved caps.—Species 250 or more, in many parts of the world, well represented in E. U. S.

There are two horticultural groups of lobelias,—the annuals and the perennials. The annuals are low normally blue-flowered species suitable for bedding and edgings. They are of the easiest culture either from seeds or cuttings. See *L. Erinus* (No. 1). The perennials are again of two types,—the hardy and the half-hardy or tender. The hardy kinds are natives, of which *L. cardinalis* and *L. syphilitica* are the leading representatives. These inhabit bogs and low places, and the best results under cultivation are to be expected in moist and cool spots. The half-hardy sorts are chiefly derivatives of the Mexican *L. fulgens*, a plant deservedly popular in the Old World, but which has not attained great favor here. These species may be bedded out in the northern states. They are carried over winter in pots or in a cellar. They usually give good results the first year from seed, if started early; or seeds may be sown in the fall and the plants carried over in a frame. The hardness of the hybrid perennial lobelias in this country is yet to be determined. It is probable that forms of *L. fulgens* will stand outdoors in the middle states if given winter protection. In the latitude of Washington they are hardy in winter but are scarcely able to withstand the summers.

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- A. Plant annual (or so treated), low and diffuse-growing.
B. Beards or hairy tufts on only the 2 lower anthers.

1. *Erinus*, Linn. (*L. heterophylla*, Hort., sometimes, not Labill. *L. gracilis*, Hort., not Andr. *L. bicolor*, Sims). Figs. 2187, 2188. Diffuse and half-trailing annual or perennial, much used for edgings: glabrous or slightly hairy below, 6–12 in. high: lvs. variable, the lower ones obtuse and obovate or spatulate and crenate-toothed, the upper ones oblanceolate or oblong (becoming linear and acute near the top of the st.), and mostly sharp-angle-toothed: fls. $\frac{1}{2}$ – $\frac{3}{4}$ in. across, on slender pedicels, light blue or violet with a lighter center (throat white or yellowish); calyx-lobes awl-like, spreading, as long as the corolla-tube; 3 lower lobes of corolla large and spreading. S. Afr. "Stony places in flats and on mountains." B.M. 514; 901.—One of the commonest of all annual edging plants, particularly for early season effects. In our hot climate, it often ceases blooming in midsummer, but with good soil, plenty of water, and occasional cutting back, it will bloom till frost. Seeds sown in Jan. and Feb., will give blooming plants by April and May. For fls. alone, rather than for edgings, the seeds may be started later, or even sown in the open ground. For definite results in edgings, however, it is usually better to start from cuttings. In the fall, lift the best plants, and grow them in pots through the



2188. *Lobelia Erinus*.
(Natural size)

winter as stocks from which to secure cuttings. Cuttings taken in late Jan. or Feb., should give blooming plants by May. Seedlings vary, and one cannot rely on them for definite effects in design work, although they may be best for the amateur who desires only fls. Some strains of seeds, however, come very true.



2189. *Lobelia tenuior*. (X $\frac{1}{4}$ – $\frac{1}{6}$)

The species is also a good pot-plant for the winter conservatory.

Lobelia Erinus is exceedingly variable. The forms fall into three groups:

(a) *Variation in habit*: Var. *compacta* or *erecta*, dense-growing forms suitable for low, close edgings: subvarieties are blue, white and so on. The most popular bedding forms belong to this strain. The name *erecta* is often used for the taller strains. Var. *gracilis*, with slender growth and suitable for vases or baskets: blue. Var. *pumila*. Very dwarf.

(b) *Variation in color of foliage*: GOLDEN QUEEN and GOLDELSE, with yellowish foliage. Also forms with bronzy foliage, but not constant.

(c) *Variation in color and size of fls.*: Var. *alba*. White. Var. *flore-pleno*. Double. R.H. 1875:71. Var. *grandiflora*. Various large-fl. forms. Var. *kermesina*. Crimson. Var. *Lindleyana*. Rose-color, with white eye. Var. *marmorata*. Fls. marbled. Var. *Paxtoniana*. Light blue with white eye: growth straggling. Var. *Royal Purple*. Purple-blue. Var. *speciosa*. Large-fl., light azure-blue, with white eye. Var. *tricolor*. Fls. blue or pink, with white eye and carmine spots. Var. *hamburgia*, Hort., has fls. bright blue with white eye; growth very rapid, slender, making it a handsome pot or basket plant. Var. *Richardsonii*, Hort. (*L. Richardsonii*, Hort.), has long spreading or drooping sts.: lvs. cordate and crisped: fls. light blue, in a long terminal raceme. *L. multiflora* of lists presumably belongs in this species: soft rich pink.

bb. *Beards or hairs on all the anthers.* The three following species are probably not in the American trade, although they are known as cult. plants. The names sometimes occur, but the plants which they represent are probably forms of *L. Erinus*. The descriptions will enable the student to distinguish whether the species occur.

2. *gracilis*, Andr. (*L. trigonocaulis*, Hook.). A foot or less high, slender, decumbent at the base, glabrous: lower lvs. ovate and deeply cut, the upper ones narrower and pinnatifid (becoming linear and entire at the top of the st.): fls. $1\frac{1}{2}$ – $\frac{3}{4}$ in. across, blue with a whitish eye, the middle lower lobe strongly obovate, the 2 upper lobes small and curved and usually hairy; fl.-cluster long and open, more or less 1-sided; seed angled, not winged. New S. Wales. B.M. 741; 5088.

3. *heterophylla*, Labill. Much like the last, but fls. larger (the middle lobe nearly 1 in. long), and the lower lvs. parted into linear lobes; seed winged. W. Austral. B.R. 2014. P.M. 9:101.

4. *tenuior*, R. Br. (*L. ramosa*, Benth.). Fig. 2189. Erect or ascending, 12–18 in., pubescent; lower lvs. small, mostly ternately divided, the upper lvs. linear and mostly entire; fls. rather large, bright blue, borne far apart on very slender pedicels, the middle lobe much the largest and obovate; seed smooth and shining, compressed. W. Austral. B.M. 3784 (as *L. heterophylla*). B. 2:93. R.H. 1856:281; 1905:192. G.C. 11. 15:105; 111. 29:46. H.F. 7:27. G.W. 10, p. 2. G. 26:385.—It has received new attention in recent years.

AA. *Plant perennial (rarely biennial), usually tall or strict-growing.*

B. *Corolla very unequally bilabiate or 2-lipped, the lower lip 3-lobed and deflexed, the upper lip very small.*

c. *Species: fls. blue (sometimes varying to white).*

5. *Kalmii*, Linn. A slender perennial (sometimes biennial?), 6–18 in. high, glabrous, branched: lvs. narrow-spatulate to linear at the top of the st., remotely denticulate; fls. small ($\frac{1}{2}$ in. long), very light blue, in a long, loose raceme, on filiform pedicels. On wet banks and slopes and margins of bogs, in northern states, Ont., Nova Scotia; prop. by offsets. B.M. 2238.—Sold by dealers in native plants. Useful for bog-planting.

6. *syphilitica*, Linn. Strong, weedy herb, 2–3 ft., glabrous or nearly so, mostly simple: lvs. thin, oblong-oval to lanceolate, attenuate to the apex but the point mostly blunt, small-dentate or crenate-denticulate, narrowed into a very short petiole; fls. about 1 in. long in a long, wand-like, racemose spike, blue or purplish, the tube about $\frac{1}{2}$ in. long; calyx hairy and enlarging in fr.,

the lance-acuminate lobes conspicuous, and bearing auricles in the sinuses. Moist places, eastern states (Maine to La.). B.R. 537; 32:6 (as *L. glandulosa*). Mn. 7:61. Gn.M. 5:344. Var. *alba*, Hort., has nearly white fls.—Interesting plant for bog-gardens and moist borders. In dry soils it will grow, but with less vigor.

cc. *Species: fls. in shades of red (or yellow or very rarely white).*

7. *cardinalis*, Linn. CARDINAL FLOWER. INDIAN PINK. Fig. 2190. Straight-growing, glabrous or very nearly so, 2–4 ft. tall, usually unbranched: lvs. narrow, varying from oblong-ovate to lanceolate, tapering both ways, the petiole very short or none, margin irregularly serrate; fls. bright intense cardinal (rarely varying to white), the tube 1 in. long, the 3 lower lobes very narrow, the fls. borne in a long racemose spike in which the bracts are mostly very narrow and the upper ones little exceeding the pedicels; calyx hemispherical, the tube much shorter than the long-linear lobes; seeds distinctly tuberculate. Wet places, as in swales. New Bruns. to Sask., and Fla. B.M. 320. G. 2:447. Gn.M. 1:187.—One of the most showy of all native fls., and worthy of cult. in any moist border. It has been long in cult., but has apparently given no important horticultural forms.

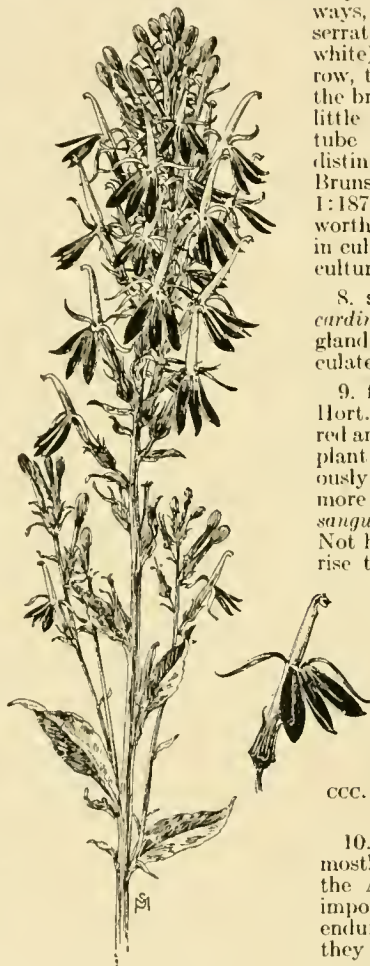
8. *spléndens*, Willd. (*L. texensis*, Raf.). Like *L. cardinalis*, but more slender, the lvs. narrower and glandular-denticulate, mostly sessile; seeds little tuberculate. Wet places, Texas, west and south.

9. *fulgens*, Willd. (*L. formosa*, Hort. *L. cardinalis*, Hort., in part). Very like the last, but fls. larger, deeper red and more showy, the 3 lobes of the lower lip broader: plant mostly pubescent (at least the foliage), and variously tinged or spotted with brown or bronze; bracts more leafy. Mex. B.M. 4002 (as *L. splendens* var. *atrasanguinea*).—Long in cult. and a most desirable plant. Not hardy without protection in the N. It has given rise to many horticultural forms, some of which (as "Queen Victoria") are commonly referred to *L. cardinalis*. The trade name *L. cardinalis atrosanguinea* probably belongs to this species. *L. cardinalis Nansieniana*, a purple-carmine sort, is probably *L. fulgens*. In Eu., *Lobelia fulgens* is one of the popular bedding plants, but it has never gained popularity in Amer. In this country it is usually grown in pots and treated as a conservatory subject.

ccc. *Species-hybrids or derivatives: fls. mostly in shades of red, pink or purple.*

10. *hybrida*, Hort. The hybrid garden lobelias are mostly of French origin, and they are little known in the American trade, although they are occasionally imported by amateurs. It is doubtful whether they will endure the winters of the northern states, although they make excellent pot subjects for blooming in the summer border. They may also be planted in the open and lifted on the approach of winter: or new stock can be raised from divisions of the old plants, or from offsets, or from seeds. Many of these hybrids are most showy, and they should be better known in Amer. It is probable that they are derived chiefly from *L. fulgens*, although they are said to come largely from *L. cardinalis*, but *L. fulgens* and *L. cardinalis* are confused amongst gardeners. *L. syphilitica* has also, apparently, entered into some of these hybrid derivatives, particularly those with blue or purple colors, and *L. amana* is supposed by some to be involved (see suppl. list). These hybrids are sometimes known collectively as *L. hybrida* and *L. perennis hybrida*. Two recent forms deserve separate mention (Nos. 11, 12):

11. *Gerárdii*, Hort. Habit of *L. fulgens* or *L. cardinalis*: lvs. lanceolate or lance-oblong, glabrous, denticulate; fls. in a heavy terminal spike or raceme, rich



2190. *Lobelia cardinalis*. (pl. $\times \frac{1}{2}$)

violet, $1\frac{1}{2}$ in. or more long. Obtained by Chabanne and Goujon of the Botanic Garden of Lyons, and intro. to the trade in 1895 by Rivoire Père et Fils, Lyons. The hispid calyx suggests *L. syphilitica*. R.B. 22, p. 112. I.H. 42, p. 268.—It varies into rose-color (var. *lugdunensis*), and into coral-red, violet-purple, and the like. The pistillate parent was a form of *L. syphilitica* and the staminate parent was the "Queen Victoria" form of *L. fulgens*. The plant was named for M. Gérard, director of the botanical collection at Lyons.

12. *Rivôirei*, Hort., Fig. 2191, comprises still more recent types, with very large rose or pink fls. Gn. 56:182, which plate represents several derivative lobelias. G.C. III. 24:233. G.W. 4, p. 127.

BB. Corolla somewhat equally 2-lipped, the lower lip only notched, the upper one 2-parted.

13. *laxiflora*, HBK. (*Syphocampylus bicolor*, Don). Tall, branching herb or subshrub, with thinly hairy sts.; lvs. lanceolate or ovate-lanceolate, acuminate, sharp-denticulate; fls. nodding, on long, axillary pedicels, $1\frac{1}{2}$ in. long, cylindrical, the stamens projecting from the side, red and yellow, pubescent. Mex.—An old plant requiring cool greenhouse cult., or thriving in the open in pots. It may also be planted out like *L. fulgens*. Var. *aurea*, Hort., is a yellow-fl. variety. Var. *angustifolia*, DC. (*L.*

2191. *Lobelia Rivôirei*. ($\times \frac{1}{3}$)

Cavanillesii, Hort.). Lvs. long and narrow, sometimes even linear; fls. scarlet with orange-yellow lip; corolla 1 in. long. Mex. B.M. 3600 G.C. III. 1:585; III. 57:263. A good tall subject for pots in a greenhouse and for planting-out in summer. Seeds sown in Feb. should give blooming plants in Aug.

BBB. Corolla with all the lobes united by the tips into 1 lip.

14. *Tûpa*, Linn. (*Tûpa montana*, Hort. *T. Feuilléei*, Don. *Lobelia Feuilléei*, Hort.). Very strong herb or subshrub (4-7 ft. tall), erect and mostly simple; lvs. oblong-oval, mostly acuminate, rugose, tomentose, denticulate; fls. in a long, terminal raceme, blood-red, 2 in. long, the hooded lip curving downwards and the column of stamens ascending; calyx-lobes short. Chile. B.M. 2550. G.C. III. 52:243. R.H. 1898, p. 189. G.W. 4, p. 139.—Cool greenhouse; hardy in southern states with protection.

L. amœna, Michx. Much like *L. syphilitica*, but the calyx plain and not hispid; corolla $\frac{1}{2}$ in. long, bright blue. N. C., south.—*L. anceps*, Thunb. Perennial, blue-fl., with somewhat fleshy lvs. and 2-winged st. S. Afr. B.M. 2277 (as *L. decumbens*): 2519 (as *L. rhizophyta*).—*L. coronopifolia*, Linn. Somewhat shrubby, with pinnatifid hairy lvs. and handsome blue fls. (sometimes 1 in. long), on long scapes. S. Afr. B.M. 644. G.C. II. 15:105.—*L. Dortmanna*, Linn. WATER LOBELIA. Aquatic perennial, 1 ft. or less, with lvs. radical and submerged, and small pale blue fls. on a scape. Useful amongst aquatic plants. Native.—*L. heterodonta*, Sprague. Erect, 3 ft. or more (perennial?). Lvs. sessile, lanceolate, serrate; fls. pale green in a long raceme, the lobes about 1 in. long. Trop. Amer.—*L. hortensis*, DC., is a hybrid form of *L. amœna*, probably not in cult. now.—*L. inflata*, Linn. INDIAN TOBACCO. Annual, of N. Amer., with ovate, pubescent, denticulate lvs., erect habit, and small blue or whitish fls.; herbage very acrid; plant formerly a domestic remedy.—*L. linnæoides*, Petrie. One of the New Zeal. lobelias: perennial, creeping; lvs. orbicular or ovate-orbicular, toothed; fls. white, purplish beneath, the corolla $\frac{1}{2}$ in. long.—*L. nicotianifolia*, Heyne. A striking perennial, 6 ft. and more; st. as thick as the arm at base; lvs. narrow-lanceolate, to 2 ft. long; fls. white (or pale lilac) in a branching inf. 2 ft. or more long. S. India. B.M. 5587. G.C. III. 35:195.—*L. sensitifolia*, Lamb. from Kamtschatka: perennial, 1 ft. or so; fls. violet-blue, produced freely; lvs. broad, serrate; requires a wet place. G. 29:541.—*L. subnuda*, Benth. Annual from Mex., with radical lyrate lvs. and small pale blue fls. on long pedicels. G.C. III. 2:304.—*L. taliensis*, Diels. Erect, to 4 ft. (perennial?); lvs. narrow-obovate or obovate-oblong; fls. blue, 1- $1\frac{1}{4}$ in. long. W. China. L. H. B.

LOBLOLLY BAY: *Gordonia Lasianthus*.

LOBOSTÈMON (Greek *lobe* and *stamen*: the stamens opposite the corolla-lobes). *Boraginaceæ*. Perennial herbs and shrubs, rough-pubescent or hispid, with alternate sessile often granular lvs., and white or blue fls. mostly in terminal cymes and heads. They are closely allied to *Echium*: species perhaps 50 in S. Afr. Apparently none is in the trade, although *L. formosus*, Buck (*Echium formosum*, Pers. *E. grandiflorum*, Andr.), is likely to be found in choice collections: shrubby and branched, 3 ft.: lvs. lanceolate to obovate-lanceolate; fls. reddish changing to blue, in spicate racemes. B.M. 1772. B.R. 36 (both as *E. fruticosum*).

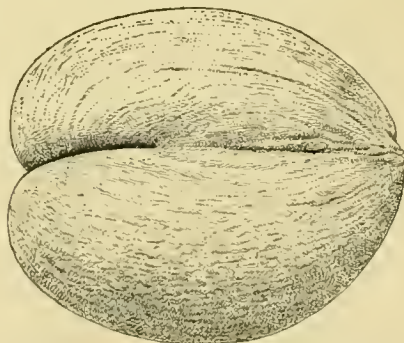
LOCHÈRIA (for Dr. Hans Locher of Zurich). *Gesneriaceæ*. Comprises a few species, which are now referred to *Achimenes*. In the trade are 2 species, *L. heterophylla*, (Erst., or *L. ignescens*, Klotzsch (see *Achimenes heterophylla*, p. 207), and *L. hirsuta*, Regel (see *Achimenes hirsuta*, DC., p. 208, suppl. list).

LOCO-WEED: *Astragalus*; *Oxytropis*.

LOCUST: Common locust is *Robinia Pseudacacia*. Honey L., *Gleditsia triacanthos*. Swamp or Water L., *G. aquatica*.

LODOÏCEA (said to be a modification of *Laodice*, daughter of Priam). *Palmaceæ*. DOUBLE COCONUT. COCO DE MER. MALDIVE-NUT, from the specimens found on the shores of the Maldiv Islands in early days. One remarkable palm in the Seychelles (Indian Ocean), bearing an immense double nut which is one of the curiosities of the vegetable kingdom; the tree is sometimes seen in botanic gardens.

maldívica, Pers. (*Cocos maldívica*, Gmel. *Borassus Sonnerati*, Giseke. *Lodoicea calliphyce*, Comm. *L. sechellarum*, Labill.). Fig. 2192. Tall dioecious palm, large in all its parts: lvs. palmately not deeply cut into many flabellate lobes or segms., the blade 6 ft. across, ovate-subrhomboid, cuneate at base, the segms. bifid, petiole 8-10 ft. long; fls. in axillary spadices which are subtended by several truncate spathes, the male fls. in clusters in the hollows of the axis of the spadix and the female fewer and in cups or receptacles formed by a pair of bractlets; stamens in male fls. about 36, the pistil rudimentary; ovary in female fls. mostly 3-celled, the stamens being represented by staminodia: the great fr. usually 1-seeded, mostly 2-lobed: male spadix to



2192. The double coconut.—*Lodoicea maldívica*.

6 ft. long; female spadix of similar length, pendulous on a peduncle 1 ft. long; perianth $\frac{1}{2}$ in. long. B.M. 2734-8. G.C. II. 25:557; III. 4:732; 8:417. F.S. 5:523. Journ. N. Y. Bot. Gard. 7:8, 9 (1906).

The double coconut is one of the giants among palms, its straight and smooth trunk frequently reaching a height of 100 feet, and it is also a centenarian before its full growth is attained. The seeds of *Lodoicea* are probably the largest known, the individual nuts

being said to weigh sometimes fifty pounds, though the largest usually seen in collections do not likely exceed about fifteen pounds. The formation of such gigantic seeds requires a considerable period of time, and from the time of flowering to the full maturity of the seeds is said to cover a period of nearly ten years. The germination of such seeds is not an easy process, requiring much room and strong heat, the radicle being correspondingly large and running down for 3 feet or more before the top growth begins. Young plants require a strong and moist heat; and a considerable amount of root room, in combination with a light but rich compost, is best adapted to their needs. Seeds sometimes require three years to germinate. They are not advertised for sale at present, but have been sold as curiosities now and then in America. Their germination is a great event, but the plants are never grown to any considerable height, as they require too much care and room. The old nut remains attached at the surface of the ground until the tree is some years old. It is said that the heart of the crown of lvs. is eaten, as in the cabbage palm, and the lvs. are used in house-building.

L. H. B.†

LESÈLIA (John Læsel, an early Prussian botanist). *Polemoniaceæ*. Greenhouse plants, grown in the open far South, for their flowers.

Very close to *Gilia*, and often confused with it; and the genus is variously defined. As accepted by Peter in Engler & Prantl, it comprises 16 species in N.W. N. Amer., Mex., Cent. Amer. and northwestern Trop. S. Amer. The species occur very little north of Mex., however. As finally outlined by Gray (Suppl. Syn. Fl.), it has "fls. involucre or involucllate; both bracts and calyx wholly or partly scarious; corolla funnel-form, either regular or 1 or 2 sinuses deeper; seeds winged or margined, the surface becoming mucilaginous when wetted; suffruticose, rarely annual, with spinulose-toothed lvs."

L. coccinea, Don, is a handsome plant with brilliant rose-red tubular-trumpet-shaped fls. an inch long in terminal fascicles or compound bracted racemes, with stamens and 3-lobed stigma exserted: lvs. small and stiffish, oval or cuneate-oval, sharply and often spinulose dentate, grayish green; plant strict, pubescent, woody, perennial. Winter bloomer. It is offered in Calif. **L. tenuifolia**, Gray, and **L. effusa**, Gray, of S. Calif., are phlox-like plants offered some years ago. The former, Gray subsequently referred to *Gilia tenuifolia*, Gray, and the latter to *Gilia Dianthi*, Kellogg.

L. H. B.

LOGANBERRY. Figs. 2193, 2194. The loganberry was originated by Judge J. H. Logan, of Santa Cruz, California. It is the result of a cross between the Aughinbaugh, a variety of *Rubus vitifolius*, the wild blackberry of California, and a red raspberry, probably the Red Antwerp. It was a chance hybrid developed from seed in 1881. Since that time the cultivation of the plant has increased extensively. It is cultivated all the way from southern California to British Columbia. However, while being a very vigorous plant, it is very tender and will not succeed where the temperature reaches zero unless protected and even under protection does not seem to fruit as heavily as it does where very mild winters are experienced.

A few years ago it was thought that the loganberry industry was overdone. This was due to the poor shipping character of the fruit and the fact that the berry was but little known; but at the present time not nearly enough fruit can be secured for canning and evaporating, and the berry promises to be one of the best horticultural assets of the Pacific coast. It is one of the very strongest-growing brambles and has a characteristic dark green foliage which it holds throughout the year.

The fruit when thoroughly ripe is of a purplish red and is very large, being one of the largest berries grown. In flavor and habits it shows the characteristics of both the blackberry and raspberry. Unless very ripe the fruit is exceedingly acid, but when thoroughly ripe has a pleasant acid flavor.

In western Oregon the fruit is coming to be of tremendous commercial importance. Salem is the principal center of the industry of the state, there being about 2,000 acres planted in that vicinity and the present outlook is that the acreage will be at least doubled. Extensive plantings are found all over western and southern Oregon. Many of the cultivators are taking hold of the loganberry industry in an extensive way, individual growers planting out as many as 200 acres in one season, while others are devoting from 100 to 200 acres purely for propagation purposes.

There are two other berries being grown in this same area which are very similar to the loganberry, one being the *Primus*, which is a blackberry-raspberry hybrid, introduced by Luther Burbank. It is an excellent home berry but cannot be picked easily until it is too soft to ship. It is also too shy a bearer to be commercially profitable. The *Phenomenal* is also a hybrid introduced by Luther Burbank and is supposed to be a cross between the California dewberry and the red raspberry. It is less acid than the loganberry. The fruit, if anything, tends to run a little larger, is a little brighter in color, the foliage is a lighter green and is a better shipper than the loganberry, but it does not yield nearly so well. It does not seem to be so long-lived and it is thought by the growers that it is not so good an evaporating berry as the loganberry. As far as the Pacific Northwest is concerned, the loganberry is driving the other hybrids from the market.

The loganberry tends to vary greatly in its seedlings and offers one of the best fields for plant-breeding to be found among small-fruits.



2193. Loganberry. (× 25)

It will grow on any of the well-drained loams and is found to succeed well on the red hill soils and the silty loams along the rivers. It is thought by many of the growers that it prefers a clay subsoil rather than a gravelly or sandy subsoil. When planted on deep rich loams the plant seems to be longer-lived. There are commercial plantings in Oregon fourteen years old that are still very profitable. The principal

requisite as regards soil and place is that the drainage must be very good, as the plant is an exceptionally heavy feeder.

The loganberry is propagated very easily by rooting the tips in the fall. In choosing plants to set out, one should choose either very vigorous-rooted tips, or else vigorous one-year-old plants. It is not advisable to plant the cutting or weak tips.

The fruit has not been grown commercially long enough as yet to demonstrate conclusively the best methods, especially as related to the distances of planting. Some growers put the rows as close together as 6 feet, some prefer 7 feet, but the larger number plant them 8 feet apart each way. The plants are set in the rows from 4 to 16 feet apart. When the plants are set as close together as 4 feet, the pruning is very different from that when planted at the greater distances. When planted close together the plants are kept headed back.

It is customary to train the plant as a trailer. It will be some time before it will be demonstrated thoroughly which method of pruning and training is superior, and naturally the distances at which the plants should be set will depend greatly on the soil in which they are grown.

The plants should be given very good care the first year. They do not tend to make a strong growth until the fall months, when the growth is very rapid. In the fall, good strong trellises should be provided. The most common method is to get good strong 7-foot cedar posts. These are set 30 feet apart. Two wires are generally strung on these posts, the first wire being 2 feet from the ground, the second one at or near the top of the post. Number 12 galvanized iron wire makes a very good wire for stringing. It is customary to run the rows north and south in order to obtain a good distribution of sunlight. There are many methods used in training the vines on the wires. Some growers practise the twining together of two or three fruiting canes, fastening them in a bundle to the wires. Others start out the canes in a fan shape. One of the best systems, and one that is meeting with considerable favor, is the weaving of the vines in and out among the wires. This weaving is performed whenever a shoot tends to come out in the row. This method seems to give a very good distribution of the fruiting canes along the wire. It is thought by many growers that it is well not to try to train the plants too high, since the finest berries are grown in the shade and one must take into consideration the convenience of the pickers.

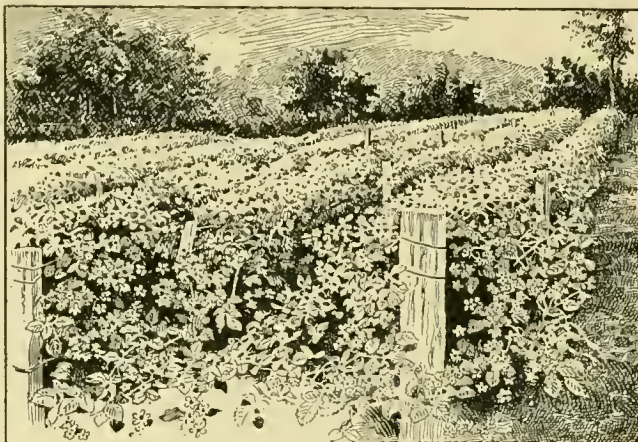
So far, the pruning consists chiefly of cutting out the old canes and the general practice is to remove these canes as soon as the fruit is picked in July, thus minimizing any danger from disease.

The training of the new shoots for the succeeding year's growth may be done during the season or left until fall. A few of the growers wait until spring, thinking that if they have an unusually cold winter their plants are thus protected. In the growing season if the new plants interfere with the tillage or handling of the crop, they are generally kicked in under the fruiting canes. Sometimes small stakes are driven down to hold them in place.

The tillage given to the loganberry is very similar to that given other cane-fruits. If they suffer for lack of moisture or food, the berries become very small. Some growers practise plowing the ground up toward the plants in the fall and away in the spring. The most common practice is to leave the ground heaped up somewhat around the plants, as this usually means that the plants become deeper rooted and the moisture-

supply is better held than when the ground is kept level.

The yield will vary tremendously, extremes probably being one to seven tons to the acre, with about four tons an acre as a very good average. A number of the growers the past year reported at least six tons, and one patch of 424 vines produced 425 crates. At the present prices and with the heavy yields the profits are very satisfactory. The wholesale price is 4 cents a pound, either for canning or evaporating. These figures



2194. The loganberry as grown in Oregon.

mean a profit of \$100 to \$300 an acre. Some of the growers have contracted their crop up to 1920.

Thus far there are no troublesome insects and only one disease, namely, the cane anthraenose, which is very similar to the anthraenose that attacks other cane-fruits.

At the present time, the demand is many times greater than the supply for both canning and dried berries. The reason for this is that the loganberry has proved to be one of the best pie berries on the market. It makes a very excellent jelly, and its juice is a very refreshing beverage and is thought by many to be superior to grape-juice. Undoubtedly in the near future the juice manufacture will become a very extensive industry. At the present time such cities as Chicago, St. Paul, Omaha, and St. Louis, are unable to buy the quantities of dried and canned loganberries that they desire.

The berries are consumed fresh, but to be relished must be thoroughly ripe. Unless in a ripe condition the acid is so strong as to be unpleasant. Canned berries are generally put up in enameled tin cans, (since the common tin cans are eaten by the acid).

In evaporating the berry, the common prune-drier is used. The berries are spread on trays of galvanized iron mesh wire. The trays are about 36 by 20 inches and the fruit is piled $\frac{1}{2}$ to 1 inch deep on these trays. It takes from sixteen to twenty-four hours to evaporate the loganberry and probably twenty-four hours turns out a better product than when only sixteen hours is given. The tunnel drier is about as good a drier as can be used. The fruit is first placed in a temperature of 135° to 150° and this temperature is gradually increased until 165° is reached. The berries should be nicely dried in 16 hours; some seasons in less time. The product will be better than when the temperature is started low. The berries should be carefully selected and only ripe berries used, as the green berries do not dry well. It is almost impossible to dry them and even though they do dry they are too tart. If the fruit is uniformly ripe it dries very uniformly; but if it is over-ripe it tends to drip badly, cara-

mels and burns easily. The wholesale price for the dried product is at the present time about 28 cents a pound. The berries dry down to about one-fifth, so that a twenty-five-pound crate will produce five pounds of dried fruit, although the percentage of the dried fruit to the fresh fruit will vary considerably. The first few pickings dry down more than those which come later, and should there be heavy rains the berries grow very large and luscious but contain relatively more water. It costs roughly about a cent a pound to dry the berries, although the commercial evaporators are charging about 3 cents for each dried pound. After drying, the berries are allowed to sweat and are handled about the same way as blackcap raspberries. They are then packed in boxes which hold either twenty-five or fifty pounds each.

Since the prune and the loganberry grow on similar soils successfully and both can be evaporated in the same drier, there are a number of growers who are combining these two crops. Thus a greater revenue is derived from the money invested in the evaporators. Loganberries come into bearing the second year and bear heavily the third, while the prune bears some the fifth year but not heavily until the seventh. The average evaporator will cost about \$2,000 and such a building can handle the product of 40 acres.

As yet the loganberry is sold only in the United States. No attempt has been made to send it to foreign countries. This is due to the fact that the growers have not been able to satisfy the buyers who come to them. The future for this berry appears to be promising, the indications being that it will be many years before the demand can be satisfied.

C. I. LEWIS.

LOGÂNIA (James Logan, Governor of Pennsylvania in Colonial times). *Loganiaceæ*. About 20 herbs and shrubs of Austral. and probably 1 in New Zeal., with mostly small white or flesh-colored more or less imperfect fls. Lvs. opposite: corolla campanulate or the tube cylindrical, the lobes 4 or 5; stamens 4 or 5, inserted in the tube; ovary 2-celled, becoming an ovoid or globular or oblong deliquescent caps. The loganias are seldom cult. They probably require the treatment of other coolhouse Australian things. *L. floribunda*, R. Br., is an erect shrub with lanceolate or linear lvs. and white fls., of which the females are usually smaller than the males, in axillary short cymes or panicles. L.B.C. 12:1118. *L. latifolia*, R. Br., is an erect shrub or undershrub, often glaucous, with broadly obovate to oblong-elliptic lvs. and white fls. in dense terminal cymes. Both species grow about 3 or 4 ft. high.

LOISELEÛRIA (after J. C. A. Loiseleur-Deslongchamps, physician and botanist in Paris, 1774-1849). Syn., *Chamaledon*, *Chamaecistus*, *Eriaceæ*. A procumbent hardy evergreen shrub with very small, mostly opposite, closely set, entire lvs., and with small, usually rose-colored fls. in terminal, few-fl. umbels. A single species in the subarctic regions and high mountains of the northern hemisphere, allied to *Kalmia* and *Ledophyllum*, but calyx 5-parted, nearly as long as the bell-shaped corolla, stamens 5, with the anthers opening lengthwise and caps. 2-3-celled. Well adapted for rockeries, forming depressed tufts, but not easy to grow and rarely cult. It grows best in a sunny or partly shaded position in a porous, peaty and sandy soil, which is well drained and has a constant but moderate supply of moisture. Prop. by seeds treated like those of *rhododendron* or by cuttings of half-ripened wood under glass. *L. procumbens*, Desv. (*Azalea procumbens*, Linn. *Chamaecistus procumbens*, Kuntze). Only a few inches high, quite glabrous: lvs. petioled, oval to narrow-oblong, revolute at the margin, about $\frac{1}{2}$ in. long; fls. 1-5, on rather short pedicels, pink or whitish, about $\frac{1}{2}$ in. across. July, Aug. L.B.C. 8:762. G.C. III. 53:343.

ALFRED RENDER.

LÔLIUM (the ancient Latin name). *Gramineæ*. **DARNEL**. RYE-GRASS. Tufted grasses with flat blades and slender spikes.

Spikelets several-fl., sessile, placed edgewise on opposite sides of a zigzag axis.—Includes about 6 species of Old World grasses, 2 of which are intro. in the eastern states and are familiar fodder grasses of the same region. Perennial rye-grass was probably the first pasture grass to be cult. in Great Britain, and is grown there yet to a considerable extent, where it is said to occupy the same relative position of importance that timothy does here. A weedy species, *L. temulentum*, reputed to be poisonous to cattle, is supposed to be the "tares" of Scripture. It is the darnel, although that name is sometimes, but perhaps erroneously, applied to other species. Our 2 cult. species are short-lived perennials or the second scarcely more than an annual, not to be recommended for permanent pasture or lawn, but are frequently employed for hay or annual pasture. They are successful only in the moist regions of the eastern states. Seed sown in autumn or early spring, 25-30 lbs. to the acre. Rye-grass is often sown in lawn mixtures to give a quick covering to the soil, especially in large expanses such as parks and public grounds. It is replaced gradually by other constituents of the mixture that are more permanent. The loliums are agricultural grasses, scarcely grown for ornament or as garden plants.

perénne, Linn. **PERENNIAL RYE-GRASS**. One to 3 ft. high, with shining lvs. and slender spike, 4-10 in. long; spikelets 8-16-fl., awnless or only short-awned. Dept. Agric., Div. Agrost. 7:301.

multiflorum, Lam. (*L. italicum*, A. Br.). **ITALIAN RYE-GRASS**. Regarded by many as a variety of the preceding. Differs chiefly in having longer awns to the florets. Ibid 302.—This form of rye-grass is common on the Pacific Coast as a weed in open ground. It is there often called Australian rye-grass.

A. S. HITCHCOCK.

LOMÂRIA (Greek, *loma*, a forage). *Polypodiaceæ*. A generic name for a group of ferns, sometimes recognized as distinct from *Blechnum*, to which they are here referred. The species of ferns classed as *Lomaria* in *Cyclopedia of American Horticulture* have been referred to *Blechnum* in the present edition as follows: *L. ciliata* = *B. Moorei*, C. Chr.; *L. lanceolata*, Spreng. = *B. lanceolatum*, Sturm; *L. discolor*, Willd. = *B. discolor*, Keys; *L. gibba*, Labill. = *B. gibbum*, Mett.; *L. Boryana*, Willd. = *B. tabulare*, Kuhn; *L. spicant*, Desv. = *B. spicant*, Withers; *L. nipponica*, Kunze = *B. spicant* var.; *L. costaricensis* = *Plagiogyria*; *L. procera*, Spreng. = *Blechnum capense*, Schlecht., in Trop. Amer., Afr., New Zeal., etc.: rhizome short and stout, often woody, erect or prostrate; fronds many, 1-4 ft. or even to 10 ft. and more; pinnae usually very numerous, 12 in. or less long, the margins minutely toothed. Variable. Var. *chilensis* (Kaulfuss) is sometimes mentioned in horticultural literature. G. 36:45.

A recent monograph on this group of ferns recognizes it as a distinct genus, but under the generic name *Struthiopteris* which is considered to take precedence of *Lomaria*.

R. C. BENEDICT.

LOMARIÓPSIS: *Stenochlæna*.

LOMÂTIA (from Greek word for *edge*, alluding to the winged seeds). *Protacææ*. About a dozen shrubs and trees in Australia and Tasmania, and in Chile, little known in cultivation, a very few of which are in the trade. They are coolhouse subjects, and suitable for the open in the warmer parts, grown primarily for the handsome dentate, pinnate or pinnatifid foliage. They require the general treatment of the Australian cool greenhouse things; propagated by well-ripened cuttings.

Leaves variable, alternate, from entire to toothed

and bipinnatifid: fls. small, perfect, in pairs, borne in terminal or axillary racemes, white, pale yellow or reddish; perianth irregular, with an oblique tube open along lower side, the long lobes cohering in an ovoid-globular recurved limb; anthers sessile; ovary on a long stipe, with a long style and flat stigmatic disk: fr. a coriaceous foliicle. *L. ferruginea*, R. Br. (*L. pinnatifolia*, Hort.), is the species most likely to be cult.: Chile: graceful in habit, handsome, with grevillea-like foliage: lvs. 2-pinnatifid, very dark green above and tomentose beneath, the segms. ovate and 3-toothed at the point: fls. about $\frac{1}{2}$ in. long, golden yellow and scarlet, rusty-hairy outside. B.M. 8112. G.C. III. 42:232, 233. *L. obliqua*, R. Br. Chile. Shrub or tree with densely leafy erect branches: lvs. ovate, crenate, leathery, smooth and bright green, 3-4 in. long: fls. white, with rusty hairs, about $\frac{1}{2}$ in. long, in short axillary racemes. *L. longifolia*, R. Br. Austral. Erect, 8-10 ft., evergreen, glabrous or nearly so: lvs. linear-lanceolate to oblong-lanceolate, remotely serrate, 4-8 in. long: fls. greenish white, in terminal and axillary not elongated racemes, the perianth about $\frac{1}{2}$ in. long. B.M. 7698. B.R. 442.

L. heterophylla is offered as an "elegant evergreen foliage plant." L. H. B.

LOMATIUM (name refers to the *bordered* or winged fruit). *Umbelliferae*. Under this name of Rafinesque's are now separated the American plants that have been referred to *Peucedanum*. More recently, however, the name *Cogswellia* has been substituted, although lacking priority, because *Lomatium* is held to be too much like the older *Lomatia* of Robert Brown. *Lomatiums* are mostly W. American plants, of about 60 species, growing in dry soil. They are mostly low or stemless perennial herbs from tuberous or fusiform roots, and compound (ternate, pinnate or dissected) lvs. From *Peucedanum* the genus differs, according to Coulter & Rose, as follows: "*Peucedanum* consists of tall and branching mesophytic plants of low fertile meadows of the Old World, with several umbels, conical stylopodium, and solitary oil-tubes; while *Lomatium* consists of low xerophytic plants of aculeosem habit belonging to the arid regions of W. N. A., with usually single umbels terminating simple elongated peduncles, no stylopodium, and often several oil-tubes." Horticulturally, the *lomatiums* are of small value, and they have not been cult. sufficiently to have given rise to cultural forms. A few of the species have been offered by dealers in native plants. They seem to thrive well in dry exposed places. They are interesting for the front row of hardy borders and for colonizing in wild open places, and for use in rockwork. Two of the species come as far East as Nebraska and Iowa.

A. *Peduncles usually slender, never swollen at the top.*

B. *Bractlets of involucrel conspicuous, often broad or united at base.*

dasycarpum, Coult. & Rose (*Peucedanum dasycarpum*, Torr. & Gray). St. very short or wanting: peduncles several, stout, pubescent, 2 in. or less high: lvs. rather small, pinnately decompound, the numerous segms. short-linear: umbel 6-15-rayed, bearing white fls.: fr. nearly orbicular. S. Calif.

nn. *Bractlets small or wanting.*

c. *Lvs. narrow in outline, pinnate.*

Hallii, Coult. & Rose (*P. Hallii*, Wats.). Very short-stemmed, the peduncles 6-16 in. tall and glabrous: lvs. oblong in outline, the segms. ovate and deep-toothed or pinnatifid: umbel 3-6-rayed, bearing yellow fls.: fr. broadly elliptical, glabrous. Ore. and Wash., alpine.

cc. *Lvs. broad in outline, 1-3-ternate.*

platycarpum, Coult. & Rose (*P. simplex*, Nutt.). Often tall and stout, but sometimes nearly stemless:

lvs. ternate or 2-ternate, the lfts. almost filiform to linear-lanceolate: umbel 3-15-rayed, bearing yellow fls.: fr. broadly oblong to nearly orbicular, sometimes emarginate at each end. Colo. and Utah to Mont. and Wash.

triternatum, Coult. & Rose (*P. triternatum*, Nutt.). Sometimes 2-2 $\frac{1}{2}$ ft. high: lvs. 2-3-ternate, the lfts. narrow-linear to linear-lanceolate: fls. deep yellow: fr. narrowly oblong, glabrous. N. Calif. to Brit. Col.

AA. *Peduncle stout, swollen at the top.*

nudicaule, Coult. & Rose (*P. leucocarpum*, Nutt. *Smyrnium nudicaule*, Pursh). Stemless, glabrous: peduncle 12-16 in. tall, from a long, fleshy root: lvs. 1-2-ternate or 3-quinat, the lfts. thickish and ovate to narrow-lanceolate: umbel unequally 5-20-rayed, bearing yellow fls.: fr. narrowly oblong. Calif. to Brit. Col. and Idaho.

L. H. B.

LOMATOPHYLLUM (Greek compound, referring to the *bordered leaves*). *Liliaceae*. A few species in the Mascarene Isls., with the habit and perianth of *Aloe*, but differing in the red-margined or cartilaginous-margined lvs. and fr. a berry. They are fleshy subshrubs with hermaphrodite fls. and introrse anthers as in *Sansevieria*, but differ in having declined hypogynous stamens and several ovules in a cell, whereas *Sansevieria* has erect stamens inserted on the throat of the tube and solitary ovules. They are probably not in commercial cult. *L. borbonicum*, Willd. (*L. aloiflorum*, Nichols.), the Bourbon *aloe*, is the one most likely to be found in amateur collections: st. 8 ft., thick at maturity: lvs. about 3 ft. long, horny-toothed, bordered red: fls. yellow, with brown-red outside, about $\frac{3}{4}$ in. long. Mauritius. B.M. 1585 (as *Phylloma aloiflorum*).

LONAS (derivation in doubt; possibly a recombination of some of the letters of *Santolina*). *Compositae*. Species one, an unimportant hardy yellow-flowered "everlasting," known to the trade as the African daisy or *Athanasia annua*.

Leaves coarsely toothed or entire: heads small, in dense terminal corymbs, the fls. all alike; corolla yellow and regular: achene glabrous, angled and 5-ribbed; pappus cup-shaped, making a lacerated crown. The heads are about $\frac{3}{8}$ in. across, and composed entirely of disk-fls. There are 14 or more heads in the largest corymb, which may be 2 in. across. This plant was removed from *Athanasia* largely because it is an annual herb, while the *athanasias* are shrubs or subshrubs. A more fundamental reason for giving this plant a separate genus is that it has a cup-shaped pappus, while in *Athanasia* the pappus is absent or consists of small rather bristly chaff or else of hyaline hairs. The plant is of very easy cult.

inodora, Gaertn. (*Athanasia annua*, Linn.). AFRICAN DAISY. Annual, fleshy, branching, 1 ft. high: lvs. alternate, pinnatifid, the divisions linear, entire, remote: corymbs dense: seeds 5-ribbed, not hairy. Aug., Sept. Médit. region. B.M. 2276. J.H. III. 31:281.—Scarcely in cult. outside of botanic gardens, and of little horticultural importance.

N. TAYLOR.†

LONCHITIS (*lance*, from the shape of the fronds). *Polypodiaceae*. A few species in Trop. Afr., allied to *Pteris*, differing in the sori: large ferns, the segms. broad and leafy, with interlocking veins: sori marginal, crescent-shaped, or kidney-shaped, on the ultimate sinuses, the pergamataceous indusium formed of the reflexed membranous edge of the frond. They are warmhouse ferns little seen in cult. *L. pubescens*, Willd., in several forms and under various names, is the species best known horticulturally. Stipes 1-2 ft. long, woolly pubescent, the fronds 2-4 ft. long, 3-pinnate, the lower pinnæ 1 ft. or more long, woolly or downy; pinnules lanceolate and deeply cut, to $1\frac{1}{2}$ ft.

long; lfts. light green and soft, cut nearly or quite to the midrib into oblong-crenate segms. Trop. Afr., Cape, Mauritius and Seychelles.

LONCHOCÁRPUS (lance-fruit, from the shape of the pod). *Leguminosae*. Trees or climbing shrubs, in many species, in Trop. Amer. and Afr. and Austral., apparently not in the trade and little cult. Lvs. alternate, odd-pinnate, the lfts. opposite and sometimes stipellate; fls. papilionaceous, violet, purple or white, racemose or paniculate; standard very broad or rarely linear-oblong; wings oblique or falcate, lightly adhering to keel above the claw; keel arcuate or nearly straight; stamens 9 and 1: pod oblong or elongated, flat, indehiscent, the seeds few or only 1. An indigo is secured from the genus. *L. Bärteri*, Benth., is a glabrous climber from Guinea: lfts. 5-7, oblong, 5-6 in. long; fls. rose-colored, in clusters of 8 or 10. B.M. 6943. Said to be a good climber for the warmhouse. *L. roseus*, DC., from S. Amer., has lfts. 13-15, lanceolate, acuminate; fls. large and showy, rose-colored. *L. latifolius*, HBK., W. Indies, Cent. Amer. to S. Amer., a shrub or tree, has 2-4 pairs of elliptic or lance-oblong lfts., and pale purple fls.

On *L. speciosus*, Bolus, about 10 years ago Harms founded the genus *Bolusanthus* (*B. speciosus*, Harms). It is described by Bolus as a very distinct species with large and handsome bright blue fls.: tree, 15 ft. or more: lvs. stalked, the lfts. oblique-lanceolate and very acuminate; fls. 10-30 in terminal recurved or pendulous racemes. Delagoa and Transvaal.—Probably not cult. to any extent.

L. H. B.

LONGAN: *Euphoria*.

LONICERA (after Adam Lonicer or Lonitzer, a German physician and naturalist, 1528-1586). Including *Caprifolium*, *Xylosteum*, *Nintoa* and *Chamaecerasus*. *Caprifoliaceae*. HONEYSUCKLE. Ornamental shrubs grown for their handsome, usually profusely produced, often fragrant flowers and attractive berries.

Deciduous, rarely half-evergreen or evergreen, upright or climbing; lvs. opposite, usually short-petioled, entire or very rarely sinuately lobed, in a few species with distinct stipules; fls. in axillary peduncled pairs, each pair with 2 bracts and 4 bractlets, the latter often more or less connate into a cupula, sometimes wanting, or fls. in sessile whorls at the end of the branches; calyx 5-toothed; corolla with short or slender, often gibbous tube, 2-lipped or almost equally 5-lobed; stamens 5; ovary inferior, usually 2-3, rarely 5-celled; the pairs sometimes partly or wholly connate: berry few- to many-seeded.—About 175 species throughout the northern hemisphere, in Amer. south to Mex., in Asia south to Java; about 90 species, besides numerous varieties and many hybrids, are in cult. For an account of the genus see Rehder, Synopsis of the genus *Lonicera* in Ann. Rep. Missouri Bot. Gard. 14:27-232, 20 pl. (1903).

The honeysuckles belong to our most popular ornamental shrubs. They are of easy cultivation and propagation, most of them are quite hardy and the flowers, though rather small, are profusely produced, mostly of pleasing and delicate colors varying from white or yellow to pink, purple or scarlet, and followed by attractive red, yellow, white, blue or black fruits; the shrubs are never coarse or weedy, do not produce dead wood to any extent, do not need much pruning, and are long-lived.

The upright or bush honeysuckles are very valuable for shrubberies, and the low procumbent species, like *L. spinosa* var. *Alberti*, *L. thibetica*, *L. pileata*, and *L. trichosanthes*, are well suited for rockeries. Most of the cultivated species are hardy North, but *L. Standishii*, *L. fragrantissima*, *L. pileata*, *L. Ledebourii*, *L. quinquelocularis*, *L. Webbiana*, *L. rupicola*, and other Himalayan species are less hardy and need sheltered

positions or protection North. Some of the handsomest in bloom are the well-known *L. tatarica*, *L. Korolkovii*, *L. spinosa* var. *Alberti*, *L. Maackii*, *L. Morrowii*, *L. Ledebourii*. For their sweet-scented early flowers, *L. Standishii* and *L. fragrantissima* are to be recommended. Honeysuckles with very decorative fruits are *L. Morrowii*, *L. tatarica*, *L. gracilipes*, *L. alpigena*, *L. trichosanthes*, *L. Maackii* var. *podocarpa*, *L. chrysantha*. Nearly evergreen are *L. pileata* and *L. nitida*; half-evergreen, *L. fragrantissima* and *L. Standishii*. *Loniceras* thrive in almost any good garden soil, and prefer mostly sunny positions, but *L. canadensis*, *L. nigra*, *L. Ledebourii*, *L. hispida* and *L. Xylosteum* grow as well or better in partly shaded situations. Pruning may be done during winter except in the early-flowering species, like *L. Standishii*, *L. fragrantissima*, *L. gracilipes* and *L. hispida*. The climbing honeysuckles are well adapted for covering walls, arbors and other trelliswork; they have mostly handsome and often sweet-scented flowers, in the hardy *L. tragophylla* as long as 3 inches, in the tender *L. Hildebrandiana* as long as 7 inches, but are somewhat deficient in foliage, with the exception of *L. japonica*, and liable to become leafless and unsightly at the base, and therefore may be mixed with other climbers, like ampelopsis, akebia, clematis. They perhaps show their beauty to the best advantage when allowed to ramble over shrubs and small trees. Those of the *Caprifolium* group are mostly hardy North, with the exception of the species of southern Europe and *L. hispida*, while of the *Nintoa* group *L. japonica* and *L. Henryi* are hardy North, at least in a sheltered position; these species make also a very handsome ground-cover, and, like *L. Periclymenum*, grow well in shade, but the others prefer sunny positions. Propagation is by seeds sown in fall or stratified and by cuttings of ripened wood; also by greenwood cuttings under glass



2195. *Lonicera thibetica*.
($\times \frac{1}{2}$). No. 2.

in summer, but the species of the *Periclymenum* group grow less readily in this way. Most species hybridize very easily and only seeds collected from isolated plants should be used for propagation. *L. spinosa* var. *Alberti* is sometimes grafted high on stems of *L. tatarica*, thus forming a small weeping tree.

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KEY TO THE SPECIES.

- A. Fls. in axillary pairs.
- B. Habit upright, sometimes prostrate.
- C. Branches with solid white pith.
- D. Corolla with regular or nearly regular 5-lobed limb.
 - E. Tube of corolla equally tubular or campanulate: bractlets at least half as long as ovary; berries distinct: lvs. scarcely exceeding 1 in.
 - F. Stamens and style inclosed in the tube: fr. bright red.
 - G. Lvs. glabrous beneath. . . . 1. syringantha
 - GG. Lvs. tomentose beneath. . . . 2. thibetica
 - FF. Stamens and style exerted: fr. whitish or pale bluish purple, bloomy. 3. spinosa
 - EE. Tube of corolla more or less ventricose or gibbous.
 - F. Bracts narrow, usually subulate.
 - G. Ovaries and frs. distinct: fr. red.
 - H. Style exceeding the limb: fls. whitish, in pairs. 4. canadensis
 - HH. Style shorter than limb: fls. usually red, solitary. 5. gracilipes
 - GG. Ovaries and frs. connate or partly connate or ovaries tightly inclosed by a cupule.
 - H. Frs. partly or wholly connate, red: bractlets wanting: corolla ventricose, pinkish. . . . 6. tangutica
 - HH. Frs. seemingly connate, blue, bloomy: corolla gibbous, yellowish white. 7. cærulea
 - HHH. Frs. distinct, red: ovaries inclosed by a cupule: lvs. evergreen or half-evergreen.
 - I. Habit prostrate: lvs. $\frac{1}{4}$ – $1\frac{1}{2}$ in. long, usually narrowed at base. 8. pileata
 - II. Habit upright: lvs. $\frac{1}{4}$ – $\frac{1}{2}$ in. long, usually rounded at base. 9. nitida

FF. Bracts broad, enveloping the ovaries.

- G. Bractlets wanting: fls. white: fr. scarlet.
- H. Ovary glabrous or glandular: tube slender below the middle, gibbous at base. . . . 10. hispida
- HH. Ovary setose and glandular-pilose: tube thick, saccate at base. 11. chætocarpa
- GG. Bractlets large: fls. yellow or scarlet: fr. purplish black.
 - H. Stamens equalling the limb: lvs. glabrous or slightly pubescent. . . 12. involucrata
 - HH. Stamens not exceeding the mouth: lvs. pubescent beneath: corolla orange and scarlet outside. 13. Ledebourii
- DD. Corolla 2-lipped.
 - E. Terminal bud wanting, replaced by 2 axillary buds; buds with 2 outer valvate scales: fr. red.
 - F. Lvs. acuminate. 14. Standishii
 - FF. Lvs. acute or obtusish. . . . 15. fragrantissima
 - EE. Terminal bud present.
 - F. Fls. pale yellow: fr. red.
 - G. Bractlets connate into a cupule: buds with 2 valvate outer scales. . . . 16. iberica
 - GG. Bractlets minute: buds small, with imbricate scales. 17. oblongifolia
 - FF. Fls. dull violet or brownish red; bractlets small in distinct pairs: frs. connate.
 - G. Berries red. 18. alpigena
 - GG. Berries bluish black. . . . 19. orientalis
 - CC. Branches hollow, with brown pith: fls. 2-lipped; ovaries distinct.
 - D. Corolla light or deep pink, sometimes white, but not changing to yellowish.
 - E. Lvs. above 1 in. long, usually glabrous: upper lip of the corolla divided nearly or quite to the base.
 - F. Bractlets distinct; upper lip divided to the base. . . . 20. tatarica
 - FF. Bractlets connate into pairs; upper lip divided not quite to the base. 21. amœna
 - EE. Lvs. 1 in. or less long, usually finely pubescent: upper lip divided to about the middle. . 22. Korolkovii
 - DD. Corolla white or pink, changing to yellow: hybrids between No. 20 and Nos. 26 and 29.
 - E. Apex of lvs. obtusish or acute. . 23. bella
 - EE. Apex of lvs. acuminate.
 - F. Under side of lvs. nearly glabrous: bractlets glabrous or glandular-ciliate: fls. often pink. 24. notha
 - FF. Under side of lvs. pubescent: bractlets ciliate: fls. white, sometimes pinkish. . . . 25. muendeniense
 - DDD. Corolla white or pale yellow, changing to yellow or yellowish, rarely slightly pinkish.
 - E. Peduncles longer than petioles.
 - F. Winter-buds small, obtusish: ovary glabrous.
 - G. Bractlets small, glabrous or glandular. 26. Ruprechtiana
 - GG. Bractlets as long or half as long as ovary.
 - H. Lvs. acuminate: bractlets half as long as ovary. 27. muscaviensis
 - HH. Lvs. obtusish or acute, rarely short-acuminate: bractlets as long or nearly as long as ovary.

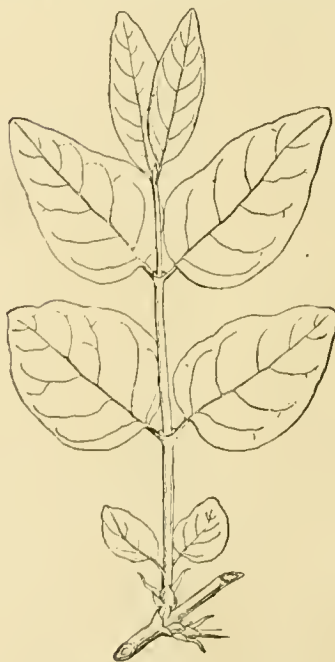
1. Under side of lvs. sparingly pubescent 28. *minutiflora*
11. Under side of lvs. densely pubescent 29. *Morrowii*
- FF. Winter-buds rather large, pointed, with long-ciliate scales; ovary glandular.
- G. Fls. whitish, often slightly pinkish; lvs. generally ovate to obovate, acute or abruptly acuminate, glabrous or soft-pubescent 30. *Xylosteum*
- GG. Fls. pale yellow changing to deeper yellow; lvs. rhombic-ovate to ovate-lanceolate, acuminate, pilose 31. *chrysanthia*
- EE. Peduncles shorter than petioles.
- F. Calyx with 5 acute teeth; lvs. acuminate 32. *Maackii*
- FF. Calyx truncate, splitting, scarious; lvs. obtuse or acutish 33. *trichosantha*
- HB. Habit climbing; branches hollow.
- C. Corolla less than 1 in. long, tube slightly ventricose; corolla dull red 34. *Henryi*
- CC. Corolla over 1 in. long, with slender tube.
- D. Bracts leafy, ovate; corolla $1\frac{1}{4}$ –2 in. long, white or purplish; lvs. more or less pubescent, half-evergreen 35. *japonica*
- DD. Bracts subulate; lvs. quite glabrous, evergreen.
- E. Length of corolla 3–4 in.; color changing from white to yellow 36. *longiflora*
- EE. Length of corolla 5–7 in.; color changing from yellow to orange-red 37. *Hildebrandiana*
- AA. Fls. in usually 6-fld. whorls at the end of the branchlets; lvs. below the infl. connate (except in No. 53).
- B. Tube of corolla 3 or more times longer than limb; limb nearly equal or short 2-lipped. (See also No. 47.)
- C. Limb regular; lvs. not ciliate 38. *sempervirens*
- CC. Limb short, 2-lipped.
- D. Lvs. ciliate 39. *ciliosa*
- DD. Lvs. not or slightly ciliate 40. *Brownii*
- BB. Tube of corolla as long to twice as long as limb; limb deeply 2-lipped.
- C. Corolla $\frac{1}{2}$ –1, rarely to $1\frac{1}{2}$ in. long; tube of corolla ventricose, or slightly gibbous, pubescent inside (except in No. 46).
- D. Bractlets at least half as long as ovary; corolla $\frac{1}{2}$ – $\frac{3}{4}$ in. long, with gibbous tube 41. *hispidula*
- DD. Bractlets one-third as long or shorter.
- E. Disk of connate lvs. elliptic, pointed at both ends, usually concave.
- F. Lvs. ciliate; branchlets pubescent; corolla glandular outside 42. *hirsuta*
- FF. Lvs. not ciliate; branchlets glabrous; corolla usually glabrous outside.
- G. Under side of lvs. pubescent 43. *glaucescens*
- GG. Under side of lvs. glabrous 44. *dioica*
- EE. Disk suborbicular or oval, rounded at the ends, nearly flat.
- F. Style and tube inside pubescent; disk usually with dense whitish bloom above 45. *prolifera*
- FF. Style and tube inside glabrous; disk bright green above or only slightly bloomay 46. *flava*

- CC. Corolla $1\frac{1}{2}$ –3 in. long; tube of corolla slender, not ventricose, glabrous inside (except in Nos. 47 and 51).
- D. Whorls of fls., at least the lower ones in the axils of connate lvs.
- E. Tube of corolla 3 or 4 times as long as limb, stamens much shorter than limb 47. *implexa*
- EE. Tube of corolla not more than $1\frac{1}{2}$ times as long as limb; stamens about as long as limb.
- F. Bractlets minute or wanting; whorls of fls. only 1 or 2 48. *Caprifolium*
- FF. Bractlets about half as long as ovaries; whorls several 49. *americana*
- DD. Whorls of fls. in peduncled heads or spikes.
- E. Lvs. below the infl. connate.
- F. Fls. in elongated spikes with remote whorls 50. *Heckrottii*
- FF. Fls. in dense heads.
- G. Corolla about 3 in. long; head short-peduncled with 1 or 2 whorls 51. *tragophylla*
- GG. Corolla $1\frac{1}{2}$ –2 in. long; heads long-peduncled, often in 3's, with several whorls 52. *etrusca*
- EE. Lvs. all distinct; fls. in a dense head 53. *Periclymenum*

Subgenus CHAMÆCERASUS.

Section ISOXYLOSTEUM.

1. *syringantha*, Maxim. Upright slender-branched shrub, glabrous; lvs. elliptic to oblong, obtuse or acutish, dull bluish green, $\frac{1}{2}$ –1 in. long; peduncle $\frac{1}{2}$ in. long; cupule shorter than ovaries; calyx-teeth lanceolate; corolla tubular-funnelform, $\frac{1}{2}$ in. long, pale rosy lilac, fragrant; stamens and style included: fr. red. May, June: fr. in Aug. W. China. B.M. 7989. R.H. 1907, p. 281. Var. *Wölfii*, Rehd. Branches more spreading, often procumbent; lvs. narrower, usually acute; fls. lilac-carmine. W. China.—Very graceful shrub producing its fragrant fls. profusely.



2196. Fly honeysuckle.—*Lonicera canadensis*. ($\times \frac{3}{8}$) No. 4.

2. *thibetica*, Bureau & Franch. (*L. rupicola* var. *thibetica*, Zabel). Fig. 2195. Shrub, to 5 ft., with wide-spreading slender, often procumbent branches; lvs. oblong-lanceolate, acute, rarely obtusish, dark green and glossy above, white-tomentose beneath, $\frac{1}{2}$ – $1\frac{1}{4}$ in. long; peduncle to $\frac{1}{2}$ in. long, cupule about half as long as ovaries; corolla tubular-funnelform, pale purple, about $\frac{1}{2}$ in. long, slightly tomentose outside, fragrant; stamens and style included: fr. red. May, June; fr. in Aug., Sept. W. China. S. T. S. 1:45. R. H. 1902, p. 449.—A dense much-branched shrub well suited for rocky slopes.

3. *spinôsa*, Jacquemont. Rigid spinescent shrub to 4 ft.: lvs. linear-oblong, about $\frac{1}{2}$ in. long: fls. $\frac{3}{4}$ in. long with slender cylindric tube and spreading limb; stamens and style exerted: fr. pale bluish red or whitish, bloomy. Himalayas. Var. *Alberti*, Rehd. (*L. Alberti*, Regel). Shrub with slender arching or pro-



2197. *Lonicera gracilipes*. ($\times \frac{1}{2}$). No. 5.

cumbent branches: lvs. linear or linear-lanceolate, sometimes with 2-4 teeth at the base, glaucous or bluish green, $\frac{1}{2}$ - $\frac{1}{4}$ in. long: fls. on slender, erect peduncles, rosy pink, fragrant. Turkestan. Gt. 30:1065. B.M. 7394.—Very graceful shrub.

Section ISIKA.

4. *canadensis*, Marsh. (*L. ciliata*, Muhl.). Fig. 2196. Shrub, to 5 ft.: lvs. ovate or oval, acute, rounded or cordate at the base, ciliate, pubescent beneath when young, $1\frac{1}{2}$ -3 in. long: fls. slender-peduncled, always in pairs, yellowish, sometimes slightly tinged red, $\frac{2}{3}$ in. long: fr. light red. April, May: fr. in June, July. Canada to Pa. and Mich. B.B. (ed. 2) 3:281.

5. *gracilipes*, Miq. (*L. Phylomela*, Hort.). Fig. 2197. Shrub, to 6 ft., almost glabrous: lvs. roundish-ovate to oblong-ovate, ciliate, bright green, often with reddish margin, $1-2\frac{1}{2}$ in. long: peduncles slender, nodding, usually 1-fl.; corolla pink, rarely white, $\frac{2}{3}$ in. long: fr. rather large, pendulous, bright red. April, May; fr. in June. Japan. G.F. 10:265 (adapted in Fig. 2197). S.I.F. 2:73. The form described here is var. *glabra*, Miq.; the typical form has the lvs. ciliate and pubescent beneath, particularly on the midrib, and is not in cult. Var. *albiflora*, Maxim. A form with white fls. Var. *glandulosa*, Maxim. Lvs. and fls. pubescent: ovaries glandular.—A graceful species; one of the earliest to bloom, and very handsome in June with its pendulous scarlet frs.

6. *tangutica*, Maxim. Low shrub with spreading branches: branchlet glabrous: lvs. obovate to obovate-oblong, acute or obtusish, cuneate at base, ciliate, usually sparingly hairy above, glabrous and glaucescent beneath, $\frac{1}{2}$ - $1\frac{1}{4}$ in. long: fls. slender-stalked, pendulous; bracts subulate; calyx-teeth minute; corolla tubular-funnelform, slightly ventricose below the middle, limb upright, whitish, flushed pink, $\frac{1}{2}$ in. long; style exerted: fr. bright red. May, June; fr. in July. W. China. Gt. 40, p. 581.

7. *carulea*, Linn. Much-branched erect or spreading shrub, to 5 ft., with glabrous or pubescent branchlets:

winter-buds often several, superposed: lvs. often stipulate, oval or obovate to oblong-lanceolate, pubescent or almost glabrous, pale or glaucous green, 1-2 in. long: fls. short-peduncled, yellowish or greenish white, $\frac{1}{3}$ - $\frac{1}{2}$ in. long: fr. blue, bloomy; berries connate only at the base, but wholly covered by the connate bractlets and hence seemingly connate. April, May. N. Eu., N. Asia and N. Amer. B.M. 1965.—A very variable species; the typical form is a spreading shrub with elliptic to oblong lvs. glabrescent like the branchlets and occurs in Eu. and N. Asia. Var. *altaica*, Sweet (*L. Pallasii*, Ledeb.). Branchlets and lvs. hirsute: fr. subglobose. N. Eu. to Japan. Var. *edulis*, Regel. Lvs. oblong to lanceolate, pubescent like the branchlets: fr. oblong. E. Siberia, Tibet. Var. *graciliflora*, Dipp. (*L. Karelinii*, Hort., not Bunge). With upright rather slender, bright red branches, slightly pubescent: lvs. ovate to ovate-oblong, puberulous on both sides: fls. with slender tube. Var. *villôsa*, Torr. & Gray (*L. villôsa*, Muhl. *Xylôsteum Solonis*, Eaton). Shrub, to 3 ft. with upright branches: winter-buds upright, always solitary: lvs. oval or obovate to oblong, usually pubescent: corolla campanulate, tube as long or shorter than limb. N. Amer. south to Tenn., Wis. and Calif. B.B. (ed. 2) 3:281.

8. *pileata*, Oliver. Low, spreading shrub, sometimes prostrate: lvs. evergreen or half-evergreen, ovate to oblong-lanceolate, obtusish, dark green and glossy above, glabrous, $\frac{1}{4}$ - $1\frac{1}{2}$ in. long: fls. short-stalked, upright; bracts connate into a cupule inclosing the ovaries; calyx with a cap-like downward production at the base; corolla funnelform, whitish, gibbous at the base, $\frac{1}{3}$ in. long, fragrant; stamens exerted: fr. purple, surrounded at the base by the persistent cupula. April, May; fr. in July. Cent. and W. China. B.M. 8060. G.C. III. 35: 243; 47: 236. R.H. 1909, pp. 376, 377. H.I. 16:1585.—Though the fls. are insignificant, the handsome evergreen foliage and the purple frs. render it a desirable shrub; it resembles a small-ld. privet.

9. *nitida*, Wilson. Shrub, to 6 ft., with upright branches: lvs. broadly ovate to ovate-oblong, obtuse, subcordate to broadly cuneate at the base, glossy above, glabrous except short hairs on the midrib above and on the very short petioles, $\frac{1}{4}$ - $\frac{1}{2}$ in. long: corolla slightly larger: otherwise like the preceding species, of which it is possibly only a variety. W. China.—Apparently harder than the preceding species.

10. *hispida*, Pall. Shrub, with spreading bristly-hispid or glabrescent branches: winter-buds large, 2-valved: lvs. obovate to oblong, ciliate and hirsute, at least when young, sometimes glaucous beneath, $1\frac{1}{2}$ - $2\frac{1}{2}$ in. long: fls. nodding, white, funnel-form, strongly gibbous at the base, hairy outside, $1-1\frac{1}{4}$ in. long; bracts ovate, ciliate, whitish, $\frac{3}{4}$ -1 in. long; bractlets none; ovaries glabrous or glandular: fr. oblong, bright red. April, May; fr. in June, July.



Altai to Himalayas. 2198. *Lonicera involucrata*. ($\times \frac{1}{2}$). No. 12.

—Distinct and handsome with its rather large white fls. and later with its red bracteate frs.

11. *chaetocarpa*, Rehd. (*L. hispida* var. *chaetocarpa*, Batalin). Shrub, to 6 ft.: branchlets hispid and glandular: lvs. ovate-oblong or elliptic-ovate, usually acute, sparingly pubescent above, more densely beneath and



2199. *Lonicera Standishii*.
($\times \frac{1}{2}$)

pubescent, with short erect lobes, about $\frac{1}{2}$ in. long; stamens as long as limb: berries black, shining, almost inclosed by the enlarged purple bractlets. May–July. Ont. to Alaska, south to Mex. B.R. 1179. B.B. (ed. 2) 3:282. Var. *flavescens*, Rehd. (*L. flavescens*, Dipp.). Lvs. light green, thin, oblong- or ovate-lanceolate, 3–5 in. long; corolla less gibbous, yellowish. Brit. Col. to Wyo. and Utah. Gt. 37, p. 7. Var. *serotina*, Koehne. Lvs. oblong-ovate to oblong: corolla flushed bright scarlet. June–Aug. Colo. A very striking variety on account of its brightly colored fls. Var. *humilis*, Koehne. Dwarfier and with smaller lvs.

13. *Ledeboorii*, Esch. (*L. intermediæ*, Kellogg). Similar to the preceding, but more vigorous: branches sometimes sarmentose, to 15 ft. long; lvs. of firmer texture, dark green above, pubescent beneath: fls. more salver-shaped, with rounded, spreading lobes, scarlet-red outside, $\frac{3}{4}$ in. long; stamens shorter than lobes. May–July; fr. July–Sept. Calif. Gt. 2:64. R.H. 1843:373. H.U. 5:6. B.M. 8555.—Much handsomer than the preceding, but more tender.

14. *Standishii*, Carr. (*L. sinensis*, Hort. *L. Fortunei*, Hort. *L. fragrantissima* of some). Fig. 2199. Half-evergreen shrub, with spreading branches, to 6 ft.: branchlets with reflexed bristly hairs: lvs. coriaceous, oblong-ovate to ovate-lanceolate, acuminate, ciliate, bristly hairy on both sides or glabrous above, 3–4 in. long; fls. on rather short, curved peduncles, white or slightly blushed, very fragrant, $\frac{1}{4}$ – $\frac{1}{2}$ in. long; bracts linear-lanceolate, exceeding the ovaries: frs. partly connate, scarlet. March, April; fr. in June. China. B.M. 5709. G.C. III. 5:245. R.H. 1873, p. 148. Var. *lancifolia*, Rehd. Lvs. narrow-lanceolate. W. China.

15. *fragrantissima*, Lindl. (*L. caprifolioides*, Koch. *L. or Caprifolium Niagrarum*, Hort.). Similar to *L. Standishii*, but with long and slender recurving and almost glabrous branches: lvs. broadly ovate or obovate, acute, almost glabrous, but bristly on the midrib beneath and ciliate, 1–2½ in. long; corolla glabrous outside. March–May. G.C. III. 5:245. R.H. 1873, p. 169. B.M. 8585.

—Less hardy than *L. Standishii*. Both have handsome half-evergreen foliage and very early, sweet-scented, though not very showy fls.

16. *ibérica*, Bieb. Much-branched upright shrub, to 6 ft.: branchlets pubescent: lvs. roundish-ovate or ovate, acute or obtusish, cordate or rounded at base, grayish green, ciliate, pubescent on both sides, $\frac{3}{4}$ –1½ in. long; fls. short-stalked; bracts leafy, exceeding the ovary; corolla yellowish white, changing to yellow, finely pubescent, $\frac{1}{2}$ in. long; fr. bright red. June; fr. in Sept. Transcaucasia, Persia. Var. *microphylla*, Dipp. Lower: lvs. $\frac{1}{2}$ –¾ in. long.

17. *oblongifolia*, Hook. Shrub, to 5 ft.: lvs. almost sessile, oval-oblong, obtuse, pubescent beneath, 1–2½ in. long; fls. slender-peduncled; bracts and bractlets minute or indistinct; corolla hairy outside, yellowish white, sometimes tinged purplish: berries dark red, usually wholly connate. May, June; fr. in July. Que. to Manitoba, south to Pa. and Mich. B.B. (ed. 2) 3:281. Var. *altissima*, Rehd. (*L. altissima*, Jennings). Branchlets and lvs. glabrous. Pa.

18. *alpigena*, Linn. Shrub, to 8 ft., with stout branches: lvs. oblong-obovate or oblong, short-acuminate, glossy and dark green above, light green and often pubescent beneath, 2–4 in. long; fls. long-peduncled, with short usually yellowish green tube and brownish red limb: berries connate, bright scarlet, shining. April, May; fr. in Aug., Sept. Mountains of Cent. and S. Eu. H. W. 3, p. 129.—Very handsome in fruit.

19. *orientalis*, Lam. Shrub, to 10 ft., almost glabrous: lvs. elliptic or ovate to oblong-ovate, rarely oblong-lanceolate, dark green above, pale or glaucescent beneath, 2–4 in. long; fls. short-peduncled, pale violet or pinkish: fr. black, wholly connate. May, June. W. Asia to Kamshatka. The typical form has ovate to ovate-lanceolate, acuminate lvs. pubescent beneath and is not in cult. Var. *caucásica*, Zabel (*L. caucásica*, Pall.). Lvs. oval to elliptic-oblong, glabrous and glaucescent beneath. Gt. 11:359. Var. *longifolia*, Dipp. (*L. Kesselringii*, Regel. *L. kamshática* and *L. sarránica*, Hort.). Lvs. smaller, oblong to lanceolate, glabrous: corolla smaller, scarcely gibbous at base. Gt. 40, p. 124.—Fls. and frs. not very conspicuous.

20. *tatarica*, Linn. Fig. 2200. Shrub, to 10 ft., almost glabrous: lvs. cordate or rounded at the base, ovate to ovate-lanceolate, ciliate, sometimes slightly pubescent beneath when young, 1–2½ in. long; fls. slender-peduncled, pink, crimson or white, the upper lip deeply



2200. *Lonicera tatarica*. ($\times \frac{1}{2}$)

divided, spreading, with the outer lobes free to the base: bractlets distinct, small, glabrous: fr. red, rarely yellow. May, June; fr. in July, Aug. S. E. Russia to Siberia. B.R. 31. R.H. 1868:392. Gt. 18:627. B.B. (ed. 2) 3:282.—Variable in size and shade of fls. Var. *álba*, Loisel. Fls. white. Var. *grandiflora*, Rehd. (var. *álba grandiflora*, Dipp.). Fls. larger, white. Var. *sibírica*, Pers. (var. *rubriflora*, DC. var. *rubra*, Sweet. *L. punicea*, Sims. var. *purpurea*, Hort.). Fls. bright red. B.M.

2469. Var. *latifolia*, Loud. (var. *grandiflora rubra*, Pepin. var. *splendens*, Regel). Lvs. large, to 4 in. long: fls. pink, the lobes bordered light pink. R.H. 1844: 109. Gt. 18:627, fig. 1. Var. *punicea*, Lindl. (var. *speciosa*, Carr.; var. *pulcherrima*, Regel). Similar to the preceding form, but fls. deep pink. R.H. 1868: 392, fig. 1. Gt. 18:627, fig. 5. Var. *angustifolia*, Kirehu. (*L. angustata*, Wender.). Lvs. narrow-lanceolate: fls. bright pink. Var. *lutea*, Loud. (var. *xanthocarpa*, Endl.). Frs. yellow. Var. *nana*, Alphonse. Low, dense shrub: lvs. ovate-lanceolate, narrowed at base: fls. small, pinkish. Var. *parvifolia*, Jaeger (var. *gracilis*, Carr. *L. parvifolia*, Hayne, not Edgew.). Lvs. smaller, obtuse: fls. pure white, small, with broad and short lobes: fr. orange-red. Var. *micrantha*, Trautv. (var. *puberula*, Regel & Trautv. *L. micrantha*, Regel). Branchlets, peduncles, bracts and corolla puberulous: lvs. pubescent beneath. Not in cult.: the plant cult. under this name is usually the preceding variety or *L. xylostoides*. Var. *pallens*, Rehd. Lvs. smaller and narrower, bluish green: fls. small, finally almost white.

21. *amœna*, Zabel (*L. Korolkovii floribunda* × *L. tatarica*). Branchlets nearly glabrous: lvs. ovate, rounded or subcordate at the base, glabrous, 1-2 in. long: fls. very numerous, slender-stalked; bractlets small, connate into pairs; corolla $\frac{3}{4}$ in. long, pink (var. *rosea*, Zabel) or white (var. *alba*, Zabel), outer lobes of the upper lip divided nearly to the base. May, June. Of garden origin. Var. *Arnoldiana*, Rehd. (*L. Korolkovii* × *L. tatarica*). Lvs. narrow-elliptic to oblong-lanceolate, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, nearly glabrous, grayish green: fls. white, flushed pink. Very floriferous and exceedingly graceful.

22. *Korolkovii*, Stapf (*L. floribunda* var. *Korolkovii*, Zabel). Fig. 2201. Shrub, to 12 ft.: branchlets short-pubescent: lvs. ovate to narrow-elliptic, acute, rounded or narrowed at the base, slightly pubescent above, more densely beneath, bluish green, $\frac{1}{2}$ -1 in. long: fls. on slender peduncles $\frac{1}{2}$ -1 in. long; bractlets about one-third as long as ovary, connate into pairs; corolla light pink, rarely white, the upper lip divided about one-half or slightly more; tube slightly gibbous: fr. bright red. May, June; fr. in Aug. Turkestan. G.F. 7: 35. M.D. 1910, p. 117a. Var. *floribunda*, Nichols. (*L. floribunda*, Zabel, not Boiss. & Buhse). Lvs. broadly ovate to ovate, slightly cordate or rounded at the base (in the typical form generally elliptic and narrowed at the base). Gt. 42, p. 103, figs. 4-6. M. D. 1910, p. 117d. Var. *Zabelii*, Rehd. (*L. Zabelii*, Rehd. *L. floribunda glabrescens*, Zabel). Lvs. glabrous, in shape like those of the preceding variety. Gt. 42, p. 103, figs. 1-3. M.D. 1910, p. 117e. Var. *aurora*, Koehne. Lvs. ovate to elliptic: corolla with slender tube, rosy pink; bractlets about half as long as ovaries.

23. *bella*, Zabel (*L. Morrowii* × *L. tatarica*). Upright shrub with spreading branches: branchlets usually slightly pubescent: lvs. ovate to ovate-oblong, obtusish or acute, usually truncate at the base, slightly pubescent beneath or nearly glabrous, 1-2 in. long: peduncles

about $\frac{1}{2}$ in. long; bractlets nearly orbicular to ovate, one-half to three-fourths as long as ovary; corolla about $\frac{1}{2}$ in. long, white to pink, with spreading lobes, the outer lobes of the upper lip free to the base: fr. red. May, June; fr. in July, Aug. Garden origin.

24. *nôtha*, Zabel (*L. Ruprechtiana* × *L. tatarica*). Upright, strong-growing shrub: branchlets glabrous or



2202. *Lonicera Xylostium*. (× $\frac{2}{3}$). No. 30.

nearly glabrous; lvs. ovate to ovate-lanceolate, rarely elliptic, acuminate, rounded or truncate at base, slightly pubescent or nearly glabrous beneath, 1 $\frac{1}{2}$ -2 $\frac{1}{2}$ in. long: bractlets ovate, about one-third as long as ovary, rarely longer, glabrous or glandular-ciliate: corolla $\frac{3}{4}$ in. long, white, yellowish or pinkish, upper lip upright, divided to the middle or sometimes nearly to the base, tube gibbous, short: fr. red. May, June; fr. in July, Aug. Garden origin.

25. *muendeniënsis*, Rehd. (*L. bella* × *L. Ruprechtiana*). Upright shrub: branchlets pubescent: lvs. ovate to ovate-lanceolate, acuminate, rounded or narrowed at the base, dark green above, pubescent beneath, 1 $\frac{1}{4}$ -3 in. long: bracts about as long as ovary; bractlets broadly ovate, one-third to one-half as long as ovary, ciliate: corolla white or yellowish white or sometimes slightly pinkish, upper lip upright, divided nearly to the base; filaments pubescent below the middle: fr. red. May, June; fr. in July, Aug. Garden origin. Gt. 42, p. 101 (figs. 4-6).

26. *Ruprechtiana*, Regel. Shrub, to 12 ft.: lvs. ovate-lanceolate to lanceolate, acuminate, usually dark green above, grayish pubescent beneath, 2-4 in. long: fls. on rather long peduncles, pure white at first, glabrous outside; bractlets only glandular-ciliate, small, about one-third of the ovary: fr. red or sometimes yellow. May, June. Manchuria. Gt. 19:645. Var. *xanthocarpa*, Zabel (*L. gibbiflora*, Dipp.) Fls. smaller, yellowish: fr. yellow. Var. *calvescens*, Rehd. Lvs. almost glabrous except hairy nerves on under side.—This species and *L. Morrowii* are likely to hybridize with *L. tatarica*; these hybrids are very common, and may be recognized by the glabrescent foliage and the tinge of pink in the fls. The true *L. Ruprechtiana* is much rarer in gardens than its hybrids.

27. *muscaviënsis*, Rehd. (*L. Morrowii* × *L. Ruprechtiana*). Upright shrub with spreading branches: branchlets pubescent: lvs. ovate to oblong-ovate, acuminate, dark green and sparingly pubescent above, densely beneath, 1 $\frac{1}{4}$ -2 in. long: bractlets ovate, ciliate, half as long as ovary: corolla white, upper lip upright, divided to somewhat below the middle; filaments glabrous: fr. bright red. Garden origin. Gt. 42, p. 101 (figs. 1-3).

28. *minutiflora*, Zabel (*L. micranthoides* × *L. Morrowii*). Upright shrub with spreading branches: branchlets puberulous: lvs. ovate-oblong to oblong, obtuse, acutish or short-acuminate, sparingly pubescent below, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long: bractlets ovate-oblong, nearly as long as ovary: corolla with spreading limb, upper lip divided below the middle, $\frac{1}{2}$ in. long, whitish;



2201. *Lonicera Korolkovii*. (× $\frac{1}{3}$)

stamens about half as long as limb; fr. red. May, June; fr. in July, Aug. Garden origin. A.F. 28:672.—On account of the narrow and rather small foliage, the frs. show to better advantage than in many allied honey-suckles.

29. *Morrowii*, Gray. Shrub, to 6 ft., with wide-spreading branches; lvs. oval or oblong-ovate, obtusish or acute, dark green above, grayish tomentose beneath, 1-2 in. long; fls. peduncled, pure white at first, pubescent outside, upper lip divided nearly to the base, with spreading lobes; bractlets pubescent, about as long as ovary; fr. blood-red. May, June, Japan. A.F. 11:1267. Gng. 5:329. J.H.S. 35, p. 362. S.L.F. 2:73.—Very distinct in its habit; handsome in fl. and in fr. It hybridizes easily with *L. tatarica* and the hybrids are more common in gardens than the true species.

30. *Xylósteum*, Linn. Fig. 2202. Shrub, to 10 ft.; lvs. broadly oval to obovate, acute, dull green, sparingly pubescent above or glabrous, more densely pubescent beneath, rarely nearly glabrous, 1-2½ in. long; fls. peduncled, yellowish white, often slightly tinged red, hairy outside; bractlets pubescent, suborbicular, about half as high as ovary; berries dark red. May, June; fr. in Aug., Sept. Eu., W. and N. Asia, sometimes escaped from cult. B.B. (ed. 2) 3:282. H.W. 3, p. 127.—Not so ornamental as most allied species.

31. *chrysántha*, Turcz. (*L. gibbiflora*, Rupr.). Upright shrub, to 12 ft. with upright sts.; branchlets pilose, rarely glabrous; lvs. rhombic-ovate, to rhombic-lanceolate, acuminate, dark or bright green above and nearly glabrous, pilose beneath, at least on the veins, 2-5 in. long; peduncles ½-1 in. long; bractlets distinct, ovate, one-third to one-half as long as ovary; corolla ¾ in. long, yellowish white changing to yellow, upper lip divided about one-half, tube strongly gibbous, short; fr. coral-red. May, June; fr. in Aug., Sept. N.E. Asia to Cent. Japan. Gt. 12:401.—Particularly handsome in autumn with its bright red fr. Var. *Regeliána*, Zabel (*L. Regeliana*, Kirchn.). Fls. smaller, more yellowish.

32. *Maackii*, Maxim. Fig. 2203. Upright shrub, to 15 ft.; branchlets short-pubescent; lvs. elliptic-ovate to ovate-lanceolate, acuminate, dark green above, paler beneath, usually only pubescent on the veins on both sides, 2-3½ in. long; peduncles shorter than petioles; bractlets half as long or as long as ovary; calyx distinctly 5-toothed, nearly as long as ovary; corolla ¾ in. long, white, fading to yellowish, glabrous outside, fragrant, upper lip upright, divided to the middle or below, tube short, not gibbous; stamens usually only half as long as limb; fr. dark red. June; fr. in Sept.-Nov. N.E. Asia to Cent. Japan. Gt. 33:1162. G.C. III. 41:265. G. 29:411. G.W. 4, p. 235. Var. *podocarpa*, Franch. Lower and more spreading; lvs. broader, oval to elliptic, short-acuminate; ovaries raised above the bracts on a very short but usually distinct stalk; fls. slightly smaller. Cent. China. Var. *erubescens*, Rehd. A form of the preceding variety, with larger fls. flushed pinkish.—A very desirable species, the latest of the bush honey-suckles to bloom; the type is showier in bloom, while the var. *podocarpa* is most beautiful in fr. which lasts, like the dark



2203. *Lonicera Maackii*. (×½)

33. *trichosántha*, Bureau & Franch. (*L. orális*, Bata-lin). Spreading shrub with long and slender sometimes partly procumbent branches; lvs. ovate, obovate or oval, obtuse or acutish, usually rounded at the base, nearly glabrous, 1-2 in. long; peduncles shorter than petioles; bractlets broad, connate into pairs, truncate, about half as long as ovary; calyx rather large,



2204. *Lonicera japonica*; commonly known in this country as *L. Halliána*. (×½)

nearly truncate, scarious, left; corolla slightly longer than ½ in., changing from pale to bright yellow, tube strongly gibbous; fr. bright red. June; fr. in Aug., Sept. W. China.—Very handsome with its bright red fr.

Section NINTOGA.

34. *Hénryi*, Hemsl. Climbing or prostrate, half-evergreen; branchlets densely strigose; lvs. ovate-lanceolate to lanceolate, ciliate and usually pubescent on the midrib beneath, 1½-3½ in. long; fls. in the axils at the end of the branchlets, often crowded, short-stalked; bracts subulate, short; bractlets roundish, one-third as long as ovary; corolla ¾ in. long, dull purplish or yellowish red; fr. black. June-Aug.; fr. Sept., Oct. W. China. B.M. 8375. Var. *subcoriácea*, Rehd. Lvs. subcoriaceous, ovate-oblong, 2-4 in. long, not ciliate; corolla slightly longer, tube longer than limb. W. China.

35. *japónica*, Thunb. Fig. 2204. Climbing, to 15 ft. high; branchlets usually pubescent when young; lvs. half-evergreen, roundish-ovate to oblong, pubescent beneath or almost glabrous, 1½-3 in. long; fls. short-pediceled, white, changing to yellow, often purplish outside, very fragrant, glandular-pubescent outside, 1½-2 in. long; bracts leafy, ovate or oval; bractlets broad, half as long or as long as ovary; fr. black, separate. June-Aug. China, Japan; naturalized in some places from N. Y. to N. C. B.B. (ed. 2) 3:280. G.M. 45:613. M.D.G. 1901:609. Var. *aureo-reticulata*, Nichols. (*L. reticulata aurea*, Hort. *L. brachypoda reticulata*, Hort.). A form of var. *flexuosa*, with the smaller and shorter lvs. handsomely netted yellow. B.H. 21:59. G.Z. 9:48. Var. *flexuosa*, Arb. Kew. (*L. flexuosa*, Thunb. *L. brachypoda*, DC.). Less high climbing; lvs. ovate or oblong, obtusish, pubescent on both sides while young or only on the veins beneath; peduncles usually as long as petioles or shorter; corolla 1-1½ in. long, usually purplish outside, with the upper limb divided into short lobes; bractlets broad, as long as ovary. Var. *chinénsis*, Baker (*L. chinénsis*, Wats.). Lvs. ovate, acute, ciliate and pubescent only at the veins beneath, often with purplish hue beneath; peduncles usually longer than petioles; corolla 1½-2 in. long, purple outside, the upper lip divided more than one-half; bractlets narrow, about half as long as ovary. B.R. 712. B.M. 3316. L.B.C. 11:1037. Var. *Halliána*, Nichols. (*L. flexuosa Halliána*, Dipp. *Caprifolium Halliánnum*, Hort. *L. Halliána*, Hort.). Of vigorous growth; lvs. usually pubescent on both sides when young, oblong-ovate, acute, to 2½ in. long; fls. short-peduncled, white, changing to yellow; tube as long as limb; bractlets broad, half as long as ovary. The type of the species seems to differ from this variety only in having the fls. purplish outside. A.G. 12:663. Gng. 3:293.

36. *longiflora*, DC. Climbing shrub, glabrous, evergreen: lvs. oblong-lanceolate, shining above, pale beneath, 2-2½ in. long: fls. in short-peduncled pairs, sometimes crowded toward the end of branches; corolla white, changing to yellow, fragrant, 3-4 in. long, with



2205. *Lonicera sempervirens*. (X½)

very slender tube; bracts small, subulate; fr. white. S. China. B.R. 1232 (as *Caprifolium longiflorum*).—Tender. Intro. 1900, by Franceschi.

37. *Hildebrandiana*, Coll. & Hemsl. Climbing shrub, glabrous, evergreen: lvs. broadly ovate or elliptic-ovate, abruptly pointed, 4-6 in. long: fls. on stout peduncles; corolla 5-7 in. long, glabrous outside, yellow at first, changing to orange-red, with long and slender tube. Summer. Upper Burma. G.C. III. 24:219. B.M. 7677. —This has the largest fls. of any species, but is not hardy N.

Subgenus PERCLYMENUM (*Caprifolium*).

38. *sempervirens*, Linn. (*Caprifolium sempervirens*, Michx.). TRUMPET HONEYSUCKLE. Fig. 2205. High-climbing, glabrous; evergreen southward: lvs. oval to oblong, glaucous beneath, the upper connate, 2-3 in. long: fls. in peduncled interrupted spikes; corolla with almost equal limb; tube slightly ventricose, glabrous, 1½-2 in. long, scarlet or orange-scarlet, rarely yellow. May-Sept. Conn. to Fla., west to Neb. and Texas; farther north sometimes escaped from cult. B.M. 781. R.H. 1856:361. Gn. 45, p. 307. G.M. 54:724. Var. *sulphurea*, Jacques (var. *flava*, Regel. *L. flava nova*, Hort.). Fls. yellow. Gt. 2:38. Var. *superba*, Regel (var. *speciosa*, Carr.). Fls. more brilliant scarlet. F.S. 11:1128. Sometimes cult. as *L. Maguirella*, a name also applied to *L. dioica*, and to *L. Caprifolium* var. *pauciflora*. Var. *minor*, Ait. Lvs. oblong or narrow-oblong: fls. more slender, orange-red or orange-scarlet. Very free-flowering, but more tender. B.M. 1753. B.R. 556. Gn. 34:300.

39. *ciliosa*, Poir. Low sarmentose shrub: lvs. petioled, ovate or oval, glaucous beneath, glabrous but ciliate, the upper connate, 2-4 in. long: fls. in short-peduncled heads of 1 or few whorls; corolla slightly 2-lipped, with ventricose-gibbous tube, yellow to orange-scarlet, usually hirsute outside, 1¼-1¾ in. long. June, July. Brit. Col. to Calif. and Ariz. Var. *occidentalis*, Nichols. (*L. occidentalis*, Hook.). Fls. larger, glabrous outside, more brightly colored. B.R. 1457.

40. *Bröwnii*, Carr. (*L. sempervirens Bröwnii*, André. *L. etrusca* var. *Bröwnii*, Regel). Probably hybrid of *L. sempervirens* with *L. hirsuta*. Lvs. oval to oblong, glaucous beneath, the upper connate, glabrous: fls. in peduncled heads, orange-scarlet, scentless; tube gibbous at the base, longer than limb. Of garden origin. Gt. 2:38. F.S. 11:1133. Var. *plantierensis*, Rehd. (*L. plantierensis*, André). Fls. larger, more orange-colored and less deeply 2-lipped. I.H. 18:86. F.W. 1872:289. Var. *fuchsoides*, Rehd. (*L. fuchsoides*, Hort., not Hemsl.). Similar to *L. sempervirens*, but fls. 2-lipped, scarlet outside. G.F. 9:496. G.W. 5, p. 159. Var. *punicea*, Rehd. (*L. sempervirens* var. *punicea*, Dipp.). Less vigorous: corolla orange-red.

41. *hispidula*, Douglas. Bushy shrub with sarmentose branches, rarely twining, usually hirsute: lvs. oval to ovate, rounded or cordate at the base, often with foliaceous stipules, the upper connate or sometimes distinct, usually small, rarely to 2½ in. long, ciliate and pubescent, rarely glabrous: fls. in slender-peduncled and often panicled spikes, pink or yellowish, glabrous or hirsute, ½-1 in. long, with short gibbous tube. June, July. Brit. Col. to Calif. B.R. 1761. Var. *vacillans*, Gray (*L. californica*, Torr. & Gray. *L. hispidula* var. *californica*, Rehd.). Of more vigorous growth, with large lvs. to 3 in. long: corolla glandular-pubescent outside. Calif.

42. *hirsuta*, Eaton (*Caprifolium pubescens*, Goldie). Fig. 2206. High-climbing, with usually hirsute branchlets: lvs. petioled, broadly oval or ovate, obtuse, the upper connate and abruptly pointed, dark green above, pubescent on both sides when young, 2-4 in. long: fls. in short, mostly peduncled spikes, scentless, bright or orange-yellow, pubescent without, about 1 in. long, with the tube gibbous at the base; ovary and bractlets usually glandular. June, July. Vt. to Manitoba, south to Pa. and Ohio. B.M. 3103. Gn. 45, p. 307. B.B. (ed. 2) 3: 278. G.F. 9:344. (adapted in Fig. 2206).



2206. *Lonicera hirsuta*. (X½)

43. *glaucescens*, Rydb. (*L. Douglasii*, Kochne, not DC., nor Koch. *L. parviflora* var. *Douglasii*, Gray, partly). Climbing; branchlets glabrous; lvs. short-petioled or almost sessile, the upper connate, oval to obovate, glabrous above, pubescent beneath, $1\frac{1}{2}$ –3 in.



2207. *Lonicera prolifera*. ($\times \frac{1}{2}$)

long; fls. in short, almost sessile spikes; corolla yellow, mostly reddish outside and hairy, $\frac{3}{4}$ –1 in. long; tube gibbous, longer than the limb; ovary and bractlets glabrous. May, June; fr. in Sept., Oct. Ont. to the Sask., south to Pa. and Neb. B.B. (ed. 2) 3:279.

44. *dioica*, Linn. (*L. glauca*, Hill. *L. media*, Murr. *L. parviflora*, Lam.). Usually shrubby, with slender, samentose branches, rarely climbing, glabrous; lvs. short-petioled or almost sessile, the upper connate, oval to oblong, obtuse, with usually undulate and transparent margin, very glaucous beneath, $1\frac{1}{2}$ –3 in. long; fls. in sessile or short-stalked spikes, greenish or whitish yellow, often tinged purplish, glabrous outside, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, the tube gibbous, about as long as limb. May, June; fr. in Sept., Oct. Que. to Manitoba, south to Ohio and N. C. B.R. 138.

45. *prolifera*, Rehd. (*L. Sullivanii*, Gray. *Caprifolium proliferum*, Kirehn.). Fig. 2207. Climbing about 4–5 ft., very glaucous; lvs. oval or obovate, the upper connate into a large disk, becoming thickish and very glaucous above, often finely pubescent beneath, 2–4 in. long; fls. in short-stalked or almost sessile spikes; corolla pale yellow, often marked purplish outside, about 1 in. long; tube gibbous, only little longer than limb. May, June; fr. in Sept., Oct. Ont. to Manitoba, south to Tenn. R.H. 1856:221 (as *L. flava*). G.F. 3:191 (adapted in Fig. 2207). Gn. 60, p. 285.—Very handsome in fall with the abundant scarlet berries.



2208. *Lonicera flava*. ($\times \frac{1}{2}$)

46. *flava*, Sims (*Caprifolium Fraseri*, Pursh). Fig. 2208. Climbing to 10 ft.; lvs. broadly oval to elliptic, the upper connate, bright green above, glaucous beneath, glabrous, $1\frac{1}{2}$ –3 in.; fls. in a peduncled head, bright or orange-yellow, fragrant, 1– $1\frac{1}{4}$ in. long; tube slender, longer than limb. April, May. N. C. to Ky., Ga. and Ala. B.M. 1318. L.B.C. 4:338. G.F. 3:190 (adapted in Fig. 2208). Gn. 45, p. 307.—This species is rare in cult. and usually the preceding is cult. under this name.

47. *impléxa*, Ait. Much-branched, but less high-climbing, evergreen; lvs. oval to oblong-lanceolate, sessile, the upper connate into an elliptic, acute or mucronate disk, glaucous, glabrous 1–2 in. long; fls. in several whorls, each in the axils of connate lvs., scentless, yellowish white; tube slightly hairy within; limb rather short; stamens slightly exceeding the mouth. May, June. S. Eu., N. Afr. B.M. 640.

48. *Caprifolium*, Linn. (*Caprifolium hortense*, Lam. *C. perfoliatum*, Roehl. *L. pallida*, Host). Fig. 2209. Climbing; lvs. oval to oblong, the upper connate into a roundish cup, almost glabrous, 2–4 in. long; whorls usually 2 or 3, each in the axils of connate lvs.; fls. yellowish white, often slightly purplish outside and slightly hairy, to 2 in. long, fragrant; bractlets very small or none. May, June. Cent. Eu. to W. Asia. B. B. (ed. 2) 3:278. H.W. 3, p. 129.—Sometimes escaped from cult.

Var. *alba*, Ait. (*L. præcox*, Hort.). Fls. white. Var. *pauciflora*, Carr. (*L. Caprifolium rubra*, Tausch, not Weston). Fls. purple outside.

49. *americana*, Koch (*Periclymenum americanum*, Mill. *L. italica*, Schmidt. *L. etrusca*, Hort. *L. Caprifolium*, Auth.). Climbing; lvs. broadly oval to oblong-obovate, the upper connate, glabrous, 2–4 in. long; the upper whorls without connate lvs. at the base, somewhat crowded; fls. yellowish, usually purple outside and glabrous, fragrant, to 2 in. long; bractlets about half as long as ovary, smaller on the upper fls. June–Aug. Probably hybrid of *L. etrusca* and *L. Caprifolium*, much cult., mostly under the name of the latter, and sometimes escaped from cult. Gn. 45, p. 307 (as *L. etrusca* and *L. Caprifolium*); 54, p. 26. F.S. 11:1120 (as *L. Caprifolium major*). Var. *rubella*, Rehd. (*L. Caprifolium* var. *rubella*, Tausch). Fls. purple outside. Var. *atrosanguinea*, Rehd. (*L. atrosanguinea*, Carr.). Fls. dark purple outside.

50. *Heckrottii*, Rehd. Only partially climbing; lvs. elliptic or oblong-elliptic, acute, almost sessile, the upper pairs connate, glaucous beneath, glabrous, about 2 in. long; fls. in peduncled spikes with few somewhat remote whorls, purple outside and sparingly glandular, $1\frac{1}{2}$ –2 in. long; bractlets about half as long as ovary. June–Sept.—Origin unknown, probably garden hybrid



2209. *Lonicera Caprifolium*. ($\times \frac{1}{2}$)

of *L. americana* and *L. sempervirens*. One of the most free-flowering of all climbing honeysuckles.

51. *tragophylla*, Hemsl. High-climbing: lvs. short-petioled, oblong, rarely oval, obtuse or acute, bright green above, whitish beneath and pubescent at least along the midrib, 2-5 in. long; fls. in short-peduncled heads with usually only 1 or 2 whorls; bracts about one-third as long as ovary; corolla 3 in. long, yellow, glabrous, tube about 3 times as long as limb, sparingly pubescent inside. June. W. China. B.M. 8064. S.T.S. 1:46. G.C. III. 36:150. J.H.S. 28, p. 63. G. 28:289; 35:345. R.B. 32:261.—Has proved hardy as far north as Mass.

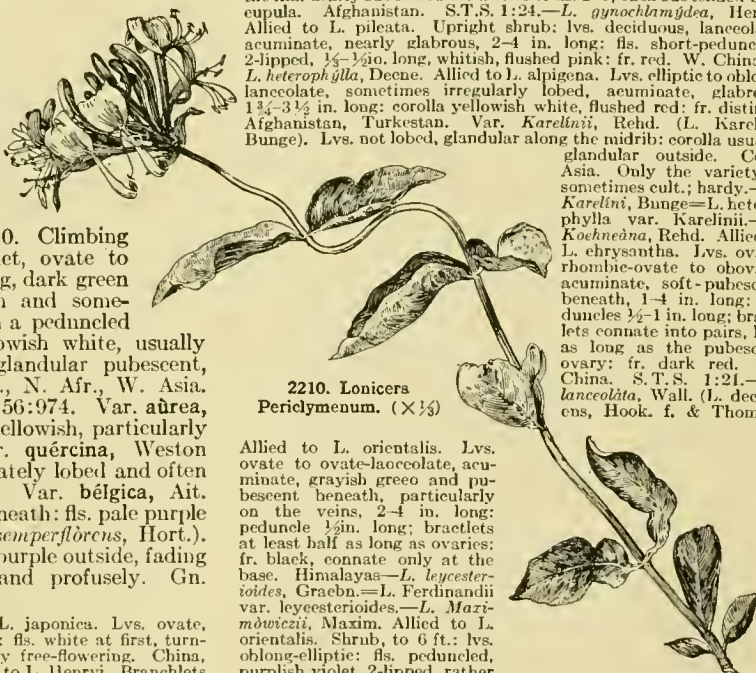
52. *etrusca*, Santi. Climbing: lvs. broadly oval to obovate, usually obtuse, the upper ones connate into an oval obtuse disk, rarely distinct, 1-3 in. long, glabrous or pubescent: fl.-heads dense, long-peduncled, often in 3's; corolla yellowish white, usually tinged red, fragrant, $1\frac{1}{2}$ -2 in. long, with very slender tube. May-July. Distributed through the whole Medit. region in many different forms. Var. *pubescens*, Dipp. (*L. gigantea*, Zabel. *L. etrusca gigantea*, Zabel). Lvs. soft-pubescent on both sides, large. Var. *superba*, Wright (*L. gigantea*, Carr.). Lvs. large, about $2\frac{1}{2}$ in. long, glabrous: fls. creamy yellow at first, finally almost orange. B.M. 7977. Probably not different from var. *glabra*, Lowe.

53. *Periclymenum*, Linn. (*Caprifolium Periclymenum*, Roem. & Schult.). WOODBINE. Fig. 2210. Climbing several feet high: lvs. all distinct, ovate to oblong-ovate, acute, $1\frac{1}{2}$ -3 in. long, dark green above, pale or glaucous beneath and sometimes sparingly pubescent: fls. in a peduncled dense head, very fragrant, yellowish white, usually carmine or purple outside and glandular pubescent, $1\frac{1}{2}$ -2 in. long. June-Sept. Eu., N. Afr., W. Asia. H.W. 3, p. 129. G.M. 45:615; 56:974. Var. *aurea*, Lind. & André. Lvs. yellow or yellowish, particularly while young. I.H. 18:59. Var. *quercina*, Weston (var. *quercifolia*, Ait.). Lvs. sinuately lobed and often with a narrow whitish margin. Var. *belgica*, Ait. Glabrous: lvs. thickish, whitish beneath: fls. pale purple outside. Var. *retotina*, Ait. (*L. sempervirens*, Hort.). Similar to the preceding: fls. dark purple outside, fading to pale purple, blooming late and profusely. Gn. 45:307.

L. affinis, Hook. & Arn. Allied to *L. japonica*. Lvs. ovate, pubescent or glabrous beneath, 2-3½ in.: fls. white at first, turning to deep yellow; bracts aubulate; very free-flowering. China, Japan.—*L. alseuosmoides*, Graebn. Allied to *L. Henryi*. Branchlets glabrous: lvs. lanceolate or narrow-lanceolate, narrowed at base: fls. slightly over ½ in. long, orange-red. W. China.—*L. Altmannii*, Regel & Schmalh. (*L. tenuiflora*, Regel & Winkl.). Allied to *L. hispida*. Shrub, to 6 ft.: branchlets pilose: lvs. broadly ovate to ovate-elliptic, pubescent below, $\frac{3}{4}$ -2 in. long; bracts ovate-lanceolate; corolla 2-lipped, whitish, $\frac{1}{2}$ -¾ in. long; fr. ovoid, scarlet. Turkestan. Var. *pilosissima*, Rehd. Lvs. only sparingly pilose on both sides. Hardy and handsome in fr.—*L. angustifolia*, Wall. Allied to *L. thibetica*. Erect shrub, to 10 ft.: lvs. lanceolate, pubescent below when young, 1-2 in. long; fls. long-peduncled, white, fragrant, with regular 5-lobed limb. Himalayas. F.S. 4, pp. 407, 408 b. Tender.—*L. arborea*, Boiss. Allied to *L. Maackii*. Erect shrub or small tree, to 30 ft.: lvs. roundish ovate, pubescent, $\frac{3}{4}$ -1½ in. long; fls. short-peduncled, 2-lipped, pinkish, small; fr. whitish. Spain. Var. *peruvica*, Rehd. (*L. nummularia*, Fisch. & Mey. *L. nummularifolia*, Jaub & Spach). Lvs. smaller, less pubescent: corolla-tube not gibbous. W. Asia to Afghanistan.—*L. arizonica*, Rehd. Allied to *L. ciliosa*: lvs. slender-petioled, 1-1½ in. long; limb of corolla nearly equal; tube slender; style glabrous. Ariz. S.T.S. 1:23.—*L. biflora*, Desf. (*L. canescens*, Schousb.). Allied to *L. japonica*. Climbing, grayish tomentose: lvs. ovate, small: fls. in pairs, white, 2-lipped, with slender, long tube, fragrant; bracts subulate. Spain, N. Afr.—*L. cerulea*, Dipp.—*L. xylosteoides*—*L. canescens*, Schousb.—*L. biflora*—*L. Chamissoi*, Bunge. Allied to *L. orientalis*: lvs. very short-stalked, oval or ovate, glabrous, 1-2 in. long; peduncles $\frac{1}{2}$ -½ in. long; fr. red. N. E. Asia.—*L. confusa*, DC. Closely allied to *L. biflora*, but fls. and lvs. somewhat larger and ovary glabrous. Japan, China. B.R. 70 (as *L. japonica*). Gn. 45, p. 307. Has been often confounded with *L. japonica*, but is easily

distinguished by the small subulate bracts.—*L. conjugialis*, Kellogg. Allied to *L. orientalis*. Erect shrub: lvs. oval or ovate, pubescent: fls. slender-peduncled, small, 2-lipped, dark purple; fr. red. Wash. to Calif.—*L. despiens*, Hook. f. and Thoms.—*L. lanceolata*.—*L. dextericalyx*, Batalin. Allied to *L. triehosantha*. Upright shrub, to 15 ft.: lvs. lanceolate, acuminate, pubescent on both sides, $1\frac{1}{2}$ -3 in. long; fls. slightly over ½ in. long; fr. orange-red. W. China. B.M. 8536.—*L. Delavayi*, Franch.—*L. similis* var. *Delavayi*—*L. depressa*, Royle—*L. Myrtillus* var. *depressa*—*L. discolor*, Lindl. (*L. orientalis* var. *discolor*, Clarke). Allied to *L. orientalis*. Lvs. ovate to ovate-oblong, glaucous and glabrous beneath; peduncles $\frac{1}{2}$ -1 in. long; fls. yellowish white, slightly pinkish. Himalayas. B.R. 33:44.—*L. diversifolia*, Wall.—*L. quinqueocularis*—*L. Ferdinandii*, Franch. Allied to *L. ibérica*. Lvs. ovate to ovate-lanceolate, acuminate, sparingly hairy, 1-2½ in. long, often with stipules: fls. short-peduncled, ¾ in. long, yellow, appressed setose outside. N. W. and Cent. China. Var. *leycesterioides*, Zabel (var. *Beissneriana*, Zabel). Less hairy: lvs. larger, to 7 in. long; corolla less setose. Only the variety is in cult.—*L. floribunda*, Boiss. & Buhse. Allied to Korolkovii. Lvs. broadly ovate to elliptic, obtuse; peduncles $\frac{1}{2}$ -¾ in., decreasing in length toward the end of the branchlets; bractlets nearly as long as ovaries. Persia. Not in cult.; the plant cult. under this name is *L. Korolkovii*—*L. Giraldii*, Rehd. Allied to *L. Henryi*. Climbing: branchlets with fulvous spreading hairs: lvs. oblong-lanceolate, hairy on both sides, $1\frac{1}{2}$ -2½ in. long; fls. crowded at the end of the branchlets, ¾ in. long, densely covered with spreading yellowish hairs. W. China. B.M. 8236. R.H. 1907, p. 299.—*L. Griffithii*, Hook. f. & Thoms. Allied to *L. Periclymenum*. Lvs. broadly ovate to ovate-oblong, the pair below the inf. nearly suborbicular; whorls of fls. 2-3, each subtended by a cupula. Afghanistan. S.T.S. 1:24.—*L. gynochlamydea*, Hemsl. Allied to *L. pileata*. Upright shrub: lvs. deciduous, lanceolate, acuminate, nearly glabrous, 2-4 in. long; fls. short-peduncled, 2-lipped, $\frac{1}{2}$ -¾ in. long, whitish, flushed pink; fr. red. W. China.—*L. heterophylla*, Decne. Allied to *L. alpigena*. Lvs. elliptic to oblong, lanceolate, sometimes irregularly lobed, acuminate, glabrous, $1\frac{1}{2}$ -3½ in. long; corolla yellowish white, flushed red; fr. distinct. Afghanistan, Turkestan. Var. *Karelinae*, Rehd. (*L. Karelinae*, Bunge). Lvs. not lobed, glandular along the midrib; corolla usually glandular outside. Cent.

Asia. Only the variety is sometimes cult.; hardy.—*L. Karelinae*, Bunge—*L. heterophylla* var. *Karelinae*—*L. Koehneana*, Rehd. Allied to *L. chrysantha*. Lvs. ovate, rhombic-ovate to obovate, acuminate, soft-pubescent beneath, 1-4 in. long; peduncles $\frac{1}{2}$ -1 in. long; bractlets connate into pairs, half as long as the pubescent ovary; fr. dark red. W. China. S.T.S. 1:21.—*L. lanceolata*, Wall. (*L. despiens*, Hook. f. & Thoms.).



2210. *Lonicera Periclymenum*. (× ½)

Allied to *L. orientalis*. Lvs. ovate to ovate-lanceolate, acuminate, grayish green and pubescent beneath, particularly on the veins, 2-4 in. long; peduncle ½ in. long; bractlets at least half as long as ovaries; fr. black, connate only at the base. Himalayas—*L. leycesterioides*, Graebn.—*L. Ferdinandii* var. *leycesterioides*.—*L. Marimowiczii*, Maxim. Allied to *L. orientalis*. Shrub, to 6 ft.: lvs. oblong-elliptic: fls. peduncled, purplish violet, 2-lipped, rather small: frs. connate, red. N. E. Asia. Gt. 17:597.—*L. micrantha*, Dipp.—*L. xylosteoides*—*L. micranthoides*, Zabel (*L. nigra* × *L. tatarica*). Similar to the latter: fls. small, reddish white; bractlets half as long or as long as ovary; stamens pubescent: fr. red. Garden origin.—*L. microphylla*, Willd. Allied to *L. tangutica*. Erect shrub, to 4 ft.: lvs. oval, about ½ in. long; fls. slender-peduncled, 2-lipped, yellowish white, small; berries connate, orange-red. Altai to Himalayas.—*L. mucronata*, Rehd. Allied to *L. fragrantissima*. Lvs. broadly oval to obovate, mucronate, $\frac{1}{2}$ -1 in. long; fls. short-stalked, white, fragrant: frs. connate, red. W. China. S.T.S. 2:122.—*L. mupinensis*, Rehd. Allied to *L. alpigena*. Bud-scales upright, lanceolate, persistent: lvs. oblong, acuminate, sparingly pilose beneath: fls. dark purple: frs. distinct, red. W. China.—*L. myrtilloides*, Purpus. Allied to *L. syringantha*. Lvs. elliptic to oblong-ovate, acute, $\frac{1}{2}$ -1½ in. long; peduncles ½ in. long; fls. pinkish white, ½ in. long, fragrant: frs. connate, red. Origin unknown.—*L. Myrtillus*, Hook. & Thoms. (*L. parvifolia* var. *Myrtillus*, Clarke). Allied to *L. ayringantha*. Lvs. oval, obovate or oblong, $\frac{1}{2}$ -1 in. long; fls. short-stalked; bracts narrow-oblong; corolla tubular-campanulate, ½ in. long, yellowish white; fr. red, connate. Himalayas. S.T.S. 1:44. Var. *depressa*, Rehd. (*L. depressa*, Royle. *L. parvifolia*, Hook. f. & Thoms.). Fls. slender-stalked; bracts broader, usually oval.—*L. nepalensis*, Kirchn.—*L. xylosteoides*—*L. nervosa*, Maxim. Allied to *L. orientalis*. Shrub, to 10 ft., with slender dark purple branchlets: lvs. ovate, with purple veins, 1-2 in. long; fls. small, pink, long-peduncled, 2-lipped; fr. black, connate only at base. China. Hardy, graceful shrub.—*L. nigra*, Linn. Allied to the preceding species. Shrub, to 5 ft.: lvs. elliptic to elliptic-lanceolate, $1\frac{1}{2}$ -

2½ in. long. fls. slender-peduncled, pink, small; fr. black. Mountains of Cent. Eu. H.W. 3, p. 128.—*L. nummularia*, Fisch. & Mey., and *L. nummulariifolia*, Jaub. & Spach= *L. arborea* var. *persica*.—*L. ascordia*, Royle. Allied to *L. tangutica*. Lvs. very small, obovate; fls. small, yellowish white, gibbous, short-stalked; frs. connate, bluish black. Himalayas.—*L. Otger*, Regel & Schmalh. Allied to *L. hispida*. Lvs. ovate to lanceolate, acute, 1½–2½ in. long; fls. short-stalked, upright, 2-lipped, over ½ in. long; fr. bright red, distinct. Turkestan.—*L. parvifolia*, Hook. f. & Thoms.= *L. Myrtillus* var. *depressa*.—*L. persica*, Jaub. & Spach= *L. arborea* var. *persica*.—*L. propinqua*, Zabel (*L. alpigena* × *L. Ledebourii*). An interesting hybrid, in one form more like the first, in the other more like the second parent. Of garden origin.—*L. prostrata*, Rehd. Allied to *L. trichosantha*. Prostrate shrub; lvs. oval or ovate, acute, ½–1 in. long; fls. small; fr. bright red. W. China.—*L. purpurascens*, Walp. Allied to *L. tangutica*. Branchlets pubescent; lvs. oval to oblong, pubescent, ¾–1½ in. long; fls. tubular-funnelform, dull purple, hairy, over ½ in. long, gibbous; fr. bluish black. Himalayas, Afghanistan.—*L. pyrenica*, Linn. Allied to *L. canadensis*. Glabrous; lvs. euneate-oblong; fls. slender-peduncled, tubular-campanulate, regularly 5-lobed, white, ¾ in. long; fra. red, distinct. Pyrenees Mts. B.M. 7774.—*L. quinquelocularis*, Harlow. (*L. diversifolia*, Wall.). Allied to *L. Maackii*. Lvs. ovate or elliptic to oblong-ovate, narrowed or rounded at base, pubescent, 1¼–2¼ in. long; fls. short-stalked; corolla ¾ in. long, with slender tube, pale yellow; fr. white. Himalayas, Afghanistan. H. 1, 9: 807. Var. *transluens*, Zabel (*L. translucens*, Carr. *L. diversifolia*, Dipp.). Lvs. rounded or subcordate at base; tube gibbous, much shorter than limb. B.R. 30:33.—*L. ramosissima*, Franch. & Sav. Allied to *L. tangutica*. Lvs. oval to ovate, pubescent, ½–1 in.; fls. long-peduncled, yellowish; bractlets connate, as long as ovaries; fr. scarlet. Japan. Very handsome in fr.—*L. retusa*, Franch. Allied to *L. orientalis*. About 6 ft. high; lvs. obovate or broadly ovate, bluish white beneath; fls. in pairs, white, becoming yellowish; fr. shining black. W. China. S. T. S. 2:123.—*L. rupicola*, Hook. f. & Thoms. Allied to *L. tibetica*. Lvs. ovate to oblong, obtuse or acutish, dull bluish green above, glabrous or pubescent beneath, ½–1 in. long; fls. pubescent outside, pale purple. Himalayas.—*L. saccata*, Rehd. Allied to *L. tangutica*. Lvs. elliptic-oblong to oblong, obtusish, pubescent beneath, ¾–2 in. long; fls. long-peduncled; bracts narrow-oblong, leafy; tube gibbous at base. Cent. and W. China. S.T.S. 1:20.—*L. segregans*, Lav. Similar to *L. Xylosteum*; lvs. more pubescent, dark bluish green; fls. short-peduncled, yellowish; fr. dark red. Of garden origin. Supposed to be a hybrid of *L. quinquelocularis* and *L. Xylosteum*.—*L. similis*, Hernal. Allied to *L. japonica*. Plant pilose; lvs. ovate-oblong to lanceolate, ciliate, white-tomentose below, 1½–3½ in. long; fls. slender-peduncled, 2 in. long, white; bracts subulate. Cent. and W. China. Var. *Delavayi*, Rehd. (*L. Delavayi*, Franch.). Glabrous, but lvs. tomentose beneath and sometimes slightly ciliate. Only this variety is in cult.—*L. splendida*, Boiss. Allied to *L. implexa* and *L. etrusca*; glabrous, glaucous; fls. in a many-fld. sessile head, yellowish white, tinged purple. Spain. F.S. 11:130. Gt. 39, p. 65.—*L. atrophophora*, Franch. Allied to *L. hispida*. Winter-buds with several scales; lvs. short-stalked, ovate, aparently hirsute, 2–3½ in. long; fls. funnelform, white, nearly ¾ in. long, with the lvs.; fr. red, distinct. Japan.—*L. subaequalis*, Rehd. Allied to *L. ciliosa*. Lvs. elliptic to obovate-oblong, glabrous, 2–5 in. long; fls. funnelform with nearly regular limb; usually only 1 sessile whorl. W. China.—*L. tenuiflora*, Regel & Winkl.= *L. Altmannii*.—*L. tomentella*, Hook. f. & Thoms. Allied to *L. tibetica*. Erect shrub, to 12 ft.; lvs. small, ovate to oblong, pubescent; fls. short-peduncled, nodding, small, regular, white; fr. connate, black. Himalayas. B.M. 6486. Tender.—*L. translucens*, Hort.= *L. quinquelocularis*.—*L. Tschonoskii*, Maxim. Allied to *L. orientalis*. Lvs. elliptic-oblong, acute at both ends, quite glabrous 2–4 in. long; fls. long-stalked, pinkish; bractlets connate, about half as long as ovaries; fr. nearly distinct, red. Japan.—*L. utahensis*, Wats. Closely related to *L. canadensis*. Lvs. broadly ovate to oblong, obtuse, not ciliate; corolla smaller, less gibbous. Brit. Col. to Ore., Utah, Wyo.—*L. Yiddii*, Franch. & Sav. Allied to *L. alpigena*. Lvs. ovate or elliptic, abruptly acuminate, pubescent, 1½–3 in. long; fls. lilac, on glandular peduncles about ½ in. long; bractlets connate, one-half or three-fourths as high as ovaries; fr. red, partly connate.—*L. Vilmorinii*, Rehd. A garden hybrid between *L. deflexicalyx* and *L. quinquelocularis*.—*L. Webbiana*, Wall. Allied to *L. alpigena*. Lvs. larger, acuminate, pubescent; fls. paler; ovaries separate. Himalayas. S.T.S. 1:69.—*L. xylostoides*, Tausch. (*L. tatarica* × *L. xylostemum*, *L. micrantha*, Dipp., not Regel. *L. cerulescens*, Dipp. *L. nepalensis*, Kirchn.). Lvs. usually rhombic-ovate, broadly cuneate at base, bluish green, slightly pubescent; corolla small, pinkish; fr. red. Garden origin.

ALFRED RENDER.

LOOSESTRIFE: *Lysimachia* and *Lythrum*.

LOPÉZIA (after the Spaniard Lopez, who wrote on the natural history of the New World). *Onagraceae*. Greenhouse plants grown for the attractive flowers; may be planted in the open far South.

Erect, branching, glabrous or pubescent; lvs. alternate or the lower opposite, dentate; fls. usually small, in leafy racemes or subcorymbose at the ends of branches, slender-pedicelled; calyx-limb 4-parted, unequal, deciduous, linear-lobed; petals 4, short- or long-clawed, unequal, the posterior ones narrower, the claws glandular at the apex; stamens 2, attached to the pistil, one anther-bearing, the other petal-like; ovary 4-celled;

caps. globose, leathery; seeds obovoid, with a leathery granulated coat.—Species a score or more, in Mex. and Cent. Amer. Little grown, but valuable for the gay forms and colors.

albiflora, Schlecht. Fig. 2211. Suffrutescent perennial, diffuse, 2 ft. high; young branches somewhat villous; lvs. euneate at the base, ovate-lanceolate to ovate, irregularly serrate or remotely dentate, largest 1½ in. long; pedicels horizontally spreading, slender; petals white, often tinged slightly pinkish at base, larger ones obliquely spatulate, obtuse and mostly notched, smaller ones linear, obtuse, equaling or exceeding the sepals. Mex.

lineata, Zucc. Shrubby, the st. and petiole usually hairy, 3 ft.; lvs. ovate, acute, crenate-serrate; fls. red, described as "insect-like," in terminal short racemes or clusters; posterior petals bearing a single gland. Mex. B.R. 26:40. G. C. III. 43:294.



2211. *Lopezia albiflora*. (×½)

miniata, DC. Slender shrubby perennial, with terete sts. which are glabrous or with lines of hairs; lvs. small, ovate-oblong, serrate; fls. many, small, the petals red in lower part, and rose-color with violet margins in upper part; posterior petals with 2 glands; sepals spreading. Mex., Guatemala. —Probably confused with the last.

macrophylla, Benth.

Semi-shrubby perennial, with green and succulent branches; lvs. long-stalked, ovate-acuminate, serrate; fls. solitary on axillary peduncles, large, bright red. Mex., Guatemala. B.M. 4724. H.F. 1:48.

coronata, Andr. Annual; lvs. scattered or in whorls, glossy, glabrous; 2 upper petals linear, bright lilac; 2 side ones larger; lamina roundish obovate, light lilac, with dark red mark at base. Mex. R.H. 1905, pp. 216, 217.—Cult. in S. Calif.

L. H. B.

LOPHANTHUS (Greek, *crested flower*; application not apparent). *Labiata*. As defined by Briquet in Engler and Prantl's "Natürlichen Pflanzenfamilien," this genus comprises 2 Asian species. They are erect herbs with dentate lvs. and axillary clusters of blue or bluish fls. *L. chinensis*, Benth. (*Hyssopus Lophanthus*, Linn.), from N. China and Siberia is sometimes planted, although apparently not in the trade. It is a nepeta-like plant, 1–1½ ft. high, with aromatic foliage, ovate lvs., and blue fls. in 3–5-fld. cyme-clusters; blooms midsummer to autumn, and useful in the alpine garden.

The few N. American species formerly held under this name are now included under *Agastache*. Two of them have been offered by dealers in native plants, but they are scarcely horticultural subjects, although useful for the wild garden. These are: *Agastache Feniculum*, Kuntze (*L. anisatus*, Benth.). GIANT HYSSOP. Height 2–5 ft.; lvs. ovate, anise-scented when crushed, white beneath; fls. blue; calyx-teeth tinged purple or violet. July, Aug. Prairies, Wis., to Rockies. *A. scrophulariæ-folia*, Kuntze (*L. scrophulariæ-folia*, Benth.). Height 4–6 ft.; lvs. not anise-scented, not white beneath; fls. dull purplish; calyx-teeth whitish. Borders of thickets, N. Y. to Wis. and N. C.

L. H. B.

LOPHOCÁRPUS: *Lonchocarpus*.

LOPHOCÈREUS (*crest* and *Cereus*). *Cactaceæ*. Stout plants growing in clusters, with few ribs. Areoles on lower part of st. very different from the upper ones; flowering areoles bearing long, bristle-like hairs standing at right angles to the st.: fls. several from each areole, small: fr. small, red.—Three species have been described.

Schöttii, Brit. & Rose (*Pilocereus Schöttii*, Lem.). Branching from the base, 10–15 ft. high, glaucous: ribs 4–10, commonly 5; spines 4–7, very short, thickened at base; areoles of the fruiting area bearing very copious and long (1–3 in.) stiffish twisted bristles: fls. small, pinkish, about 1 in. long: fr. soft, edible, the size and somewhat the color of an olive. N. W. Mex. and Low. Calif.

L. Sargentianus, Brit. & Rose, (G. F. 4:437), and *L. australis*, Brit. & Rose, are occasionally seen in cult.

J. N. ROSE.

LOPHÓPHORA (Greek, *crest-bearing*). *Cactaceæ*. Depressed globose, often proliferous and cespitose, unarmed except in seedling forms; tubercles conical, bearing at summit the flowering areole filled with white hairs: fls. from the center of the plant, small, pinkish: fr. clavate, naked, pinkish; seeds black. A very distinct genus, sometimes referred to *Anhalonium* and at other times to *Echinocactus*. Under the latter genus it was described in *Cyclo. Amer. Hort.*

Williamsii, Coult. (*Echinocactus Williamsii*, Lem. *Anhalonium Williamsii*, Lem. *E. Lewinii*, Schum. *Anhalonium Lewinii*, Hennings. *L. Lewinii*, Thomp.). Hemispherical, from a very thick root, often densely proliferous, transversely lined below by the remains of withered tubercles: ribs usually 8 (in young specimens often 6), very broad, gradually merging above into the distinct nascent tubercles, which are crowned with somewhat delicate penicillate tufts, which become rather inconspicuous pulvilli on the ribs: fls. small, whitish to rose. Texas and Mex.—The well-known "mescal button," used by the Indians in religious rites. Other Indian vernacular names are: peyotl, peyote, pellote, xicori, hicori, hieuli, huatari, camaba, sefi (Kiowa Indians), ho (Apaches), wokowi (Comanches), mescal-buttons, mezcal-buttons (Oklahoma, Texas), teonanacatl (Ancient Aztecs).—This plant is highly esteemed and even held in superstitious reverence by several tribes of Indians in the mountains of Mex. and in the U. S., on account of its narcotic properties. It is said that it produces beautiful highly colored visions. Its taste is bitter and disagreeable, and it sometimes causes vomiting. The use of the drug is accompanied by the loss of a sense of time. Its effects have been compared to those of hasheesh (*Cannabis indica*), but that narcotic produces delusions of merriment while lophophora causes a condition of ideal content followed by wakefulness. Several alkaloids have been separated from it, among them lophorine, anhalonine, and mezcaline. (See Dixon, W. E., *Journ. Physiol.*, Sept., 1899, p. 71.) This plant was first received by wholesale druggists from Mrs. Anna B. Nickels, of Laredo, Texas, who called attention to the fact that the Indians of N. Mex. and S. W. U. S. "use the plant in manufacturing an intoxicating drink, also for breaking fevers" and that the tops cut off and dried are called mescal-buttons. These dried tops, which are often strung and sold in the markets of Mex., look very much like mushrooms and were mistaken for such by the early Spaniards. The Aztecs, who applied the name nanacatl to mushrooms in general, called this plant teonanacatl, which signifies "sacred mushroom," but they had very imperfect notions of botanical distinctions, and their name may be compared to "pine-apple," which is certainly far removed from an apple. Hubert Howe Bancroft mentions this narcotic as a mushroom, and for centuries investigators have sought in vain for a Mexican fungus causing the effects attributed to the teonanacatl. Its identity, however, was

for the first time established by W. E. Safford at a meeting of the Botanical Society of Washington, May 4, 1915. For an account of the history and ceremonial use of this plant, see *Journal of Heredity*, July, 1915.

J. N. ROSE.

W. E. SAFFORD.

LOPHOSPÉRMUM: *Maurandia*.

LOQUAT. Fig. 2212. The loquat, or biwa of the Japanese (*Eriobotrya japonica*, Lindl.), is a small evergreen fruit tree with handsome foliage, considered to be a native of China and Japan. It has long been cultivated in those countries as well as in northern India; within recent years it has become fairly common in the Mediterranean basin, especially in Algeria and Sicily, and in the milder sections of the United States. In Florida and the Gulf States it is seen in dooryards and gardens, but is rarely planted in orchard form; in California its cultivation is conducted commercially. It is also grown in some tropical regions, but does not succeed so well as in the subtropics. In Japan the annual production is said to be over 20,000,000 pounds.

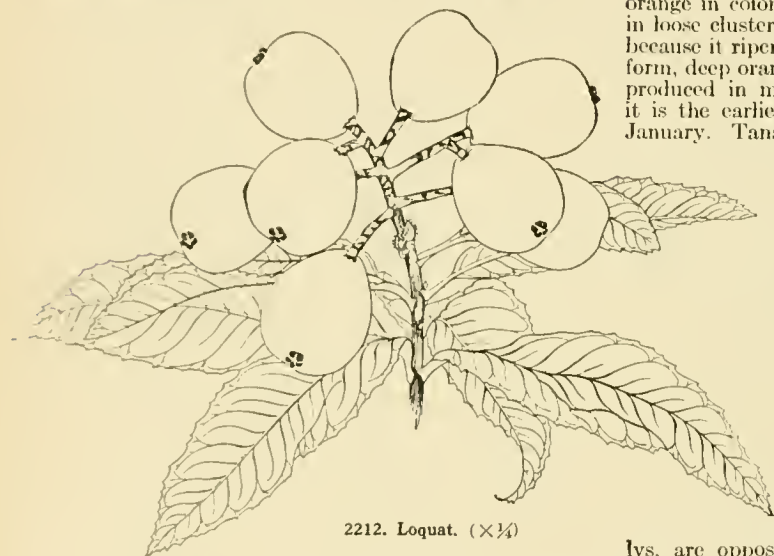
The tree, which attains an ultimate height of about 25 feet, is more or less densely clothed with elliptical to oblong-obovate, nearly sessile, remotely toothed deep green leaves, varying from 6 to 10 inches or more in length. The small, white, very fragrant flowers, which are produced in fall, are borne in crowded woolly panicles 4 to 7 inches long. The fruit, which ripens in spring, varies in shape from spherical to pyriform, in color from pale yellow to deep orange, and in the best varieties is sometimes 3 inches in length. The skin is thin and smooth, but tougher than that of an apple. The flesh is firm and meaty in some varieties, more melting in others, almost white to salmon-orange in color, juicy, and of a sprightly flavor suggestive of a cherry. The seeds, which are about $\frac{3}{4}$ inch long and dark brown in color, vary from one to eight or nine in number, four or five being common. They occupy a large amount of space in the center of the fruit, the reduction of the proportion of seed to flesh being one of the points most sought in breeding. The loquat is eaten while fresh, or is made into pies, jams, jellies, preserves and the like.

The tree is successful on a wide variety of soils, but has done best on clay loam. Ikeda, a Japanese authority, considers that the fruit reaches its highest degree of perfection when grown near the seacoast. For orchard-planting a piece of well-drained land should be chosen, and the trees set 20 to 24 feet apart. Their culture presents few difficulties; in fact the loquat will thrive and produce good crops with less care than many other fruit trees. It does not require a great amount of fertilizer on reasonably good soils, but leguminous cover-crops have been found highly beneficial. Occasional pruning is required to admit light to the center of the tree, and to keep the branches somewhat thinned out. To obtain fruit of good size and best commercial value, it may be desirable to thin the crop as soon as the young fruits have set, leaving no more in a cluster than the tree can properly mature. Picking for market should be done when the fruit has lost its acidity and is fully ripe; if picked too soon the loquat is quite sour. For jelly only acid fruit is used. When packed in boxes holding about thirty pounds, the fruit can be shipped successfully to nearby markets, but for distant markets smaller packages and great care in packing are necessary.

Pear blight (*Bacillus amylovorus*) and loquat scab (*Fusicladium eriobotryæ*) are at times troublesome in the California orchards, and a borer is reported from Japan which occasionally attacks the tree.

While in many countries the loquat is usually propagated from seed, there is as much variation among the seedlings as with other tree-fruits, and good varieties can be perpetuated only by some vegetative means of propagation. Both budding and grafting are practised,

budding being the method preferred in the United States, and usually employed when trees are desired for commercial planting. Seedlings are often planted in dooryards, where they not only serve as admirable ornamental trees, but produce an abundance of reasonably good fruit. In budding and grafting, seedling loquats are generally used as stocks. When budded on quince, the tree is considerably dwarfed; this stock is sometimes used, however, because its fibrous root-system readily permits of transplanting. Seeds should be planted as soon as removed from the fruit, either singly in pots, or in flats from which they can be potted off later on. A light loam should be used, covering the seeds to a depth of about 1 inch. When the young plants have attained a height of 6 or 7 inches, they may be planted in nursery rows in the open ground, where they can be grown until the stems are about $\frac{1}{2}$ inch in diameter at the base, when they are ready for budding. This is best done during October or November, depending upon climatic conditions. The



2212. Loquat. ($\times \frac{1}{4}$)

buds are allowed to lie dormant until early spring, when they must be forced into growth. Budwood should be of young and smooth wood, preferably that which has turned brown and lost its pubescence, and from which the leaves have dropped. Shield-budding, essentially the same as practised with the citrus fruits, is the method commonly used. The buds should be cut somewhat larger than for the orange, preferably not less than $1\frac{1}{2}$ inches in length. After inserting them in T-incisions made in the stocks at a convenient point not far above the ground, they should be tied with raffia, soft cotton string, or waxed tape, and left about three weeks, when they should have formed a union. At this time they may be unwrapped, and if necessary, rewrapped loosely, so as to allow the buds to start into growth. When not rewrapped, the bark sometimes opens up around the bud and exposes it to the air, causing its death. The stock must be cut back to a point about 3 inches above the bud, and all adventitious buds rubbed off as fast as they make their appearance. Difficulty is sometimes experienced in forcing the bud into growth.

In grafting, a simple cleft graft is used, with a cion of about the diameter of a lead pencil, and of well-matured wood.

Most of the named varieties of the loquat have originated in Japan, Algeria and California. Ikeda mentions forty-six varieties of Japanese origin, of which eight are recommended as the best for cultivation.

Trabut of Algiers describes twelve varieties of Algerian origin, though none of them is considered so desirable, from a commercial standpoint, as Tanaka, with the possible exception of Taza, which resulted from a cross between Tanaka and one of the local forms. Tanaka is of Japanese origin, but has been grown in Algeria for several years, and also to a very limited extent in California, where it has not, however, become as popular as several varieties of local origin. Most of the varieties originated in the United States have been produced by C. P. Taft, of Orange, California, who has done more to improve the loquat than any other man. Among the best may be mentioned Advance, a bright yellow, pyriform fruit, sometimes 3 inches in length, produced in very large, compact clusters and ripening from March to June; Champagne, oval to pyriform, 2 to 3 inches in length, white-fleshed, produced in clusters as large as those of Advance but less compact, considered the best of all in flavor; Premier, oval, not quite so large as Advance, salmon-orange in color; Victor, a very large and showy fruit, in loose clusters, not considered valuable in California because it ripens late in the season; Early Red, a pyriform, deep orange-colored fruit, 1 to 2 inches in length, produced in medium-sized clusters, valuable because it is the earliest of all, commencing to ripen in late January. Tanaka is an attractive fruit of large size and deep orange-color, with unusually good shipping qualities, but it ripens too late to be of commercial value in California. The earliest fruits are the ones which yield the greatest returns, because they come into market at a time when fresh fruits are scarce.

F. W. POPNOE.

LORÁNTHUS (*strap-flower*, from the form of the petals). *Loranthaceæ*. Several hundred parasitic evergreen shrubs, mostly of tropics in many countries; one of the extensive mistletoe family. They are not horticultural subjects, but attempts are sometimes made to grow them, it is said with success, by sowing them on the exposed roots or branches of their hosts. The

lvs. are opposite or alternate, entire, usually either thick or fleshy; fls. usually perfect, often showy, the 4-6 petals free or more or less joined to form a tubular corolla; calyx entire or 4-6-toothed; stamens as many as petals and attached on them: fr. a berry or drupe, with mucilaginous viscid contents. They are parasitic on upper parts of trees or shrubs or sometimes on the ground.

LOROPÉTALUM (Greek *loros*, strap, and *petalum*, alluding to the strap-shaped petals). *Hamamelidaceæ*. Ornamental shrubs grown chiefly for their white flowers, appearing in winter or early spring.

Evergreen, stellate-pubescent: lvs. alternate, short-petioled, entire, without stipules; fls. fasciated at the end of short branchlets, sessile; calyx short, 4-lobed; petals 4, linear; stamens 4, with very short filaments; ovary inferior, 2-celled; caps. woody, dehiscent, 2-seeded.—Two species in China.

Only *L. chinense* is in cultivation, a handsome much-branched shrub with rather small dull persistent foliage and clustered white or sometimes yellowish or greenish white feathery flowers in early spring. It will probably be hardy as far north as Washington, D. C. It is a desirable plant for the cool greenhouse and if grown in pots a peaty and sandy soil will suit it best. Even where the plant is hardy out-of-doors, the flowers are liable to be injured by frost. Propagation is by seeds, and probably by grafting on *Hamamelis*.

chinense, Oliver (*Hamamelis chinensis*, R. Br.). Shrub, to 12 ft.: branchlets densely ferruginous-pu-

bescent: lvs. ovate to ovate-lanceolate, acuminate, rounded and oblique at the base, glaucescent below and hairy on the veins, ciliate, 1-2 in. long; fls. in clusters of 4-5; petals strap-shaped, $\frac{3}{4}$ -1 in. long, white, yellowish or greenish white. March, April. Cent. and S. E. China. B.M. 7979. G. C. II. 19:152; III. 15:343. Gn. 65, p. 255. J.H. III. 18:235. R.H. 1904, p. 571. I.T. 2:58. G. 26:69.

ALFRED REHDER.

LÔTUS (an old Greek name). *Leguminosae*. Herbs and subshrubs, grown for the yellow, purple, rose-colored or white flowers.

Plants glabrous, silky or hirsute: lvs. with 3-5 lfts. crowded at the apex of the petiole and commonly 2 joined to the st. and resembling stipules: fls. mostly pea-shaped, often in axillary few-fl. umbels, rarely solitary; standard broad, contracted at base; wings obovate; keel incurved or inflexed, beaked; calyx-lobes longer than the tube; stamens 9 and 1, connate but free from the petals; pod oblong or linear.—Species 80-100, largely in the Medit. region, but also in S. Afr., Temp. Asia and Austral. By some botanists, the genus *Hosackia* (which see) has been united with *Lotus*, but it differs in having usually more lfts., short calyx-teeth, obtuse keel. One lotus (*L. corniculatus*) has become established in N. Amer. *Lotus nigricans* of cult. is *Kennedyia nigricans*.

Lotus meant several things to the ancients: (1) the Greek lotus, a leguminous plant on which horses fed. This was probably what we call to-day *Lotus corniculatus*, the common bird's-foot trefoil of temperate regions. (2) The Cyrenean lotus, an African shrub, the fruit of which was eaten by certain North African tribes who were called lotus-eaters. The fruit was said to be honey-sweet, the size of an olive and in taste like a date. This was probably *Zizyphus Lotus*, a prickly shrub whose fruit is, however, considered inferior to that of the common jujube, *Zizyphus sativa*. Other conjectures have been: *Celtis australis*, a tree which has a small, sweet berry; *Nitraria tridentata*, a thorny desert shrub whose succulent fruit has a stimulating quality, and *Rhamnus Lotus*, another North African plant. European lotus is a name for *Diospyros Lotus*, a kind of date plum which is cultivated in southern Europe, but the fruit is hardly edible. (3) The Egyptian lotus or sacred lily of the Nile. This is *Nymphaea Lotus*, which, like the Hindu lotus, has rose-colored as well as white flowers. American cultivators at the present time almost universally consider that the true Egyptian lotus is *Nelumbium speciosum*, now called *Nelumbo*, but *Nelumbium speciosum* is not a native of Egypt. (4) The Hindu and Chinese lotus, also called the sacred or Pythagorean bean. This is *Nelumbo indica*, better known as *Nelumbium speciosum*. The name lotus was doubtless used for other water-lilies, particularly the blue-flowered *Nymphaea caerulea*.

A. Lvs. thread-like: fls. odd, scarcely pea-shaped.

Bertholletii, Masf. (*L. peltorhyncus*, Hook. *L. pelyor-ensis*, Hort.). CORAL GEM. Small, much-branched, slender bush, with a silvery hue: lfts. whorled, 8-9 lines long; fls. $1\frac{1}{2}$ in. long, in loose clusters of about 20 toward the end of the branches, short-pedicelled, scarlet or crimson fading to orange; standard recurved like a horn; keel acuminate, longer than the wings. Cape Verde, Canaries. B.M. 6733. R.H. 1895:308; 1914, p. 185. G. 25:255. G.L. 27:169.—*Peltorhyncus* means "bruised or discolored nose." This name, however, is apparently more recent than *L. Bertholletii*. Grown chiefly in hanging-baskets; in S. Calif. it is much used for sunny rockeries. Prop. by division or cuttings. The odd long-pointed fls. make this an interesting and showy species. Var. *atrococcineus*, Hort., is an easily grown greenhouse plant for baskets, differing from the species in its darker-colored glossy deep scarlet black-spotted fls.

mascaensis, Burch. A recent species from Teneriffe: similar to *L. Bertholletii* in foliage, but more compact and bushy, with shorter branches: fls. pure shining canary-yellow, produced freely. M.D.C. 1912:253.

AA. Lvs. not thread-like: fls. pea-shaped.

B. Fls. yellow.

corniculatus, Linn. BIRD'S-FOOT TREFOIL. BABIES' SLIPPERS. Perennial, prostrate or ascending, a few in. to 2 ft. high, glabrous or hairy: lfts. obovate or ovate, $\frac{1}{2}$ in. long, the 2 stipular ones broader and very oblique: fls. yellow, often tinged bright red, 5-10 in an umbel; calyx-lobes about as long as the tube. Temperate regions and Austral.; run wild at certain places in U. S. and Canada. Var. **flôre-plêno** has showy double fls.—A hardy trailer for covering dry banks and rockwork, blooming all summer and autumn. Also grown for forage.

BB. Fls. pink or white.

austrâlis, Andr. Perennial, diffuse, sometimes shrubby, glabrous or pubescent: lfts. narrower than in *L. corniculatus*, and the stipular ones less dissimilar, but varying from obovate and under $\frac{1}{2}$ in. long, to linear and $1-1\frac{1}{2}$ in. long: fls. usually pink, but varying from white to purple-red. Austral. B.M. 1365. L.B.C. 11:1063 and B. 5:211 (as *L. albidus*).

BBB. Fls. normally dark purple or dark red.

C. Lfts. linear-lanceolate.

Jacobæus, Linn. Perennial, shrubby: lfts. few, narrow and long-acuminate: fls. about 3 in a flat-topped cluster, dark purple, almost black. Cape Verde. B.M. 79.—Treated as a tender annual bedding plant: blooms for a long season. A yellow-fl. form is mentioned.

CC. Lfts. obovate to elliptic.

Tetragonolobus, Linn. (*Tetragonolobus edulis*, Link. *T. purpureus*, Moench). WINGED PEA. Annual trailer: lfts. 3, broad-ovate: fls. solitary or twin, purplish cardinal-red: pods 4-sided, 2-3 in. long, somewhat fleshy at first; seeds yellowish, nearly globular or somewhat flattened. Medit. region. B.M. 151.—*Tetragonolobus* was once considered a separate genus, largely because of the 4 leafy wings of the pod. Grown chiefly for food, the pods being eaten when young and the seeds, when roasted, substituted for coffee. Seeds are sown in drills in April. The plants require no special care except water during drought.

WILHELM MILLER.

L. H. B.†

LOÛRYA (Jules Louis Charles Boys de Loury). *Liliaceae*; by some referred to *Hamodoraceae*. An aspidistra-like plant of recent intro.: perennial herb with creeping rhizome: lvs. basal, lengthened and stalked: fls. in dense heads or spikes at the surface of the ground; parts of perianth ovate, becoming spreading; at the throat a corona; anthers 6, sessile. One species: **L. campanulata**, Baill. Rootstock stout, subterranean: lvs. 1-2 ft. long, oblong-lanceolate, tapering at both ends: fls. basal, larger and more showy than those of *Aspidistra* and in longer spike, pale yellow (white?) with purple center, broadly campanulate, the 6 lobes broad: fr. blue, 1 in. long. Cochín-China: a very worthy plant. B.M. 7482. G.C. III. 33:107. R.H. 1889, p. 129. It looks like *Curelugo*, but differs botanically in having basal ovules and in the characters of stamens, the filaments being united in a dark purple membrane which nearly closes the tube, the anthers small and erect.

L. H. B.

LOUSEWORT: *Pedicularis*.

LOVAGE: *Levisticum*.

LOVE-IN-A-MIST: *Nigella*. Love-lies-bleeding: *Amarantus carulatus*.

LOWBERRY. A kind of bramble berry lately originated by Stuart Low & Co., Bush Hill Park, Enfield, England. In 1908, the Royal Horticultural Society gave it an award of merit as "a reputed cross between the blackberry and the loganberry, with the color of the former and the size of the latter. The fruits had been ripened under glass." It is hardy in England, making an annual growth of 12 to 18 feet; it is recommended as an ornamental plant for arbors as well as for fruit. Apparently it has not been thoroughly tested in North America.

The fruit is described as very large and long, jet-black when ripe. The flavor resembles that of the blackberry and is sweeter than the loganberry. The berries make excellent jam, with fewer seeds and less cores than that made from blackberries. The cultural treatment should be that given the loganberry.

LOWIARA. A generic name for a garden hybrid (Stuart Low & Co., England) between *Sophranitis grandiflora* and *Brassolalia* "Helen." The name follows the form of *Linneara* and *Adamara* (which see). The hybrid is *Lowiara insignis*, Rolfe. "The fls. show much of the *Sophranitis* character, but the sepals are not widely spreading; the sepals and petals are 2½ in. long, the latter nearly 1¼ in. broad, and the color dark rosy salmon; the lip is 2 in. long and entire, with an undulate erenulate margin, and the color rose-purple with a yellowish white throat; the column is broad, whitish and over ½ in. long." O.R. Dec., 1912.

LOXOSCÂPHE (Greek, *an oblique boat*). *Polypodiaceæ*. A small group of low southern hemisphere ferns of doubtful relationship; by some botanists referred to *Asplenium*, by others to *Davallia*. Indusium forming a compressed, suborbicular or cup-shaped sac, open only at the top; lvs. with linear segms. For cult., consult *Davallia*.

theciferum, Moore (*Davallia concinna*, Schrad.). Lf.-stalks 3-4 in. long; lf.-blades 6-9 in. long, bipinnate; segms. 2-3 lines long, ½ line wide. S. Amer. and Afr.

fœniculaceum, Moore (*Davallia fœniculacea*, Hook.). Lf.-stalks 6-8 in. long; lf.-blades 9-18 in. long, quadripinnate; segms. less than ½ line wide. Fiji Isls.

L. M. UNDERWOOD.

R. C. BENEDICT.†

LUCÛLIA (probably adapted from a native name). *Rubiaceæ*. Glasshouse plants grown for the flowers.

Two species of tender shrubs from the Himalaya and Khasia Mts., bearing in winter terminal corymbs sometimes a foot across, composed of 20-40 pink or white, fragrant, salver-shaped fls. with 5 rounded lobes, each fl. being 1½-2 in. across. A plant of *L. gratissima* is on record which attained 6½ ft., bearing 24 bunches of fls. each 2 ft. in circumference, beside 30 smaller bunches. Calyx-tube top-shaped; lobes unequal, deciduous; stamens 5, inserted on the tube of the corolla; filaments very short; disk annular; ovary 2-celled; style 2-branched; caps. almost woody, 2-valved, many-seeded.

For house decoration, *L. gratissima* is one of the most beautiful winter-flowering shrubs, and deserves to become more popular with florists for Christmas sales. The wood ripened after flowering furnishes the best cuttings. Newly rooted plants require a night temperature of 60° at first, but the temperature should be gradually reduced and the plants hardened off before they are planted outdoors for the summer. Young plants should never be allowed to get dry from the time of first potting until they are taken outdoors. For potting, a light soil is desirable. When the pots are well filled with roots, apply liquid manure two or three times a week until the buds appear. During the summer the plants should be syringed daily, as they are subject to red-spider. The plants should be lifted, potted and brought

indoors the last week of August. If left out later they do not set flower-buds so well. As soon as the buds appear the plants should be moved to a warmer house, with a night temperature of 55°. After flowering, the plants should be trimmed somewhat, given less water, kept in a night temperature of 45° and syringed daily. They start slowly, but make hardy growths for planting out. (George McWilliam.)

gratissima, Sweet. In the wild a tree or spreading shrub 10-16 ft.: lvs. opposite, ovate-oblong, acuminate, acute at the base, 4-6 in. long; panicle decussately branched; fls. pink or rose, forming a gorgeous rounded mass; corolla-lobes 1½ in. across, imbricated in the bud; stamens inserted in the tube, slightly exserted. Temperate Himalaya, 4,000-6,000 ft. altitude. B.M. 3946. G.C. III. 21:81; 43:12. R.H. 1843:385; 1890:180. Gn. 35, p. 58; 41, p. 469; 55, pp. 42, 107; 59, p. 49; 78, p. 623. J.H. III. 48:457; 54:459. G. 1:581; 29:671. H.F. 4:120. H.U. 4, p. 353. A.F. 7:443; 10:679.—*L. speciosa*, Hort., is apparently a form of this species with large and deep-colored fls., and strong growth.

L. Pinedana, Hook. Bush, 4-6 ft.: lvs. smaller than in above, elliptic-lanceolate and acuminate; fls. in a compound cyme, the lobes pure white above, changing to a cream, with a rosy tinge, outside rosy and the tube red. Distinguished by the presence of 5 pairs of tubercles at the base of each sinus. Khasia Mts., etc., 3,000-5,000 ft. B. M. 4132. Gn. 35, p. 59, and 41, p. 469.

WILHELM MILLER.

LUCÛMA (Peruvian name of one species). *Sapotaceæ*. A group of tropical trees and shrubs, several of which are cultivated, principally in America, for their edible fruits. Other well-known trees which belong to the same family are the sapodilla (*Achras Sapota*) and the star-apple (*Chrysophyllum Cainito*), both of which resemble the lucumas in having fruits with soft, melting flesh of very sweet flavor.

The genus is characterized by lvs. more or less elongate, usually broadened upward; by the imbricate calyx, with lobes in 1 or 2 series; and by the tubular corolla, with stamens opposite the lobes, alternating



2213. The mamey sapote.—*Lucuma mammosa*. (Spray × ½)

with the staminodes. The fr. is a berry, 2-10-celled, the seeds exalbuminous.—Species perhaps 60, mostly in Amer. but extending to New Guinea and Austral.

mammōsa, Gaertn. MARMALADE FRUIT. MAMEY SAPOTE. EGG-FRUIT. CANISTEL. Fig. 2213. A large erect tree, 30 to nearly 100 feet high, cult. in Mex., Cent. Amer., the W. Indies, and N. S. Amer. Lvs. obovate to oblanceolate, cuneate at base, rounded to acute at apex, 4-10 in. long, $1\frac{1}{2}$ -4 in. broad, glabrous, light green above, paler or brownish beneath: fls. pedicellate or subsessile, in glomerules of 2-5; calyx-lobes 8-10; corolla white, 5-lobed, ciliate; stamens 5, inserted slightly lower than the staminodes, anthers elliptic-ovate; style conical-elongate, obtuse at tip; ovary 5-celled: fr. globose to elliptical, 3-7 in. long, rusty brown, usually 1-seeded by abortion. Considered a native of Cent. Amer. Pittier has referred this species to *Calocarpum mammosum*, Pierre, while Cook makes it *Achradelepha mammosa*.

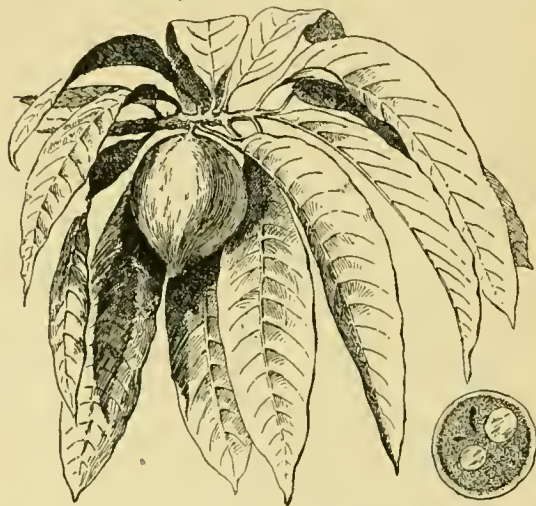
nervōsa, A. DC. (*L. Rivicōa* var. *angustifolia*, Miq.). TI-ES. EGG-FRUIT. CANISTEL. Fig. 2214. A small tree, 10-25 ft. high, with spreading branches: lvs. oblong-obovate to oblanceolate, 4-8 in. long, glabrous, bright green, acute; calyx-lobes 5, the inner ones rounded at the apex; corolla whitish, lobes ovate; style columnar, stigma slightly dilated; ovary 5-celled: fr. globose to ovoid, orange-yellow, 2-4 in. long, usually 2- or 3-seeded. A native of N. S. Amer., but cult. in other parts of Trop. Amer., naturalized on some of the Florida keys.

Caimito, Roem. (*Pouteria Caimito*, Radlk.). ANBU. A small tree, about the size of *L. nervosa*, and very similar in appearance: lvs. obovate to lanceolate, 4-8 in. long, acute, bright green, glabrous: fr. ovate-elliptical, bright yellow, 2-4 in. long, usually 2- or 3-seeded. A native of Peru, but cult. in other parts of S. Amer., especially on the coast of Brazil.

In addition to the above may be mentioned the jacana, or hakana, of Porto Rico (*L. multiflora*, DC.), with oblong or globose frs. $1\frac{1}{2}$ -2 in. diam., and sweet, mealy, yellow, edible pulp resembling in appearance the yolk of an egg, inclosing 1-3 seeds. Another noteworthy species is *L. obovata*, HBK., the "lucuma" of Peru and N. Chile, with fr. about the size and shape of a small orange, containing yellow pulp of excellent quality surrounding 1 to several seeds and inclosed in a thin, bright, dark green skin. According to W. E. Safford, specimens of this fr., usually divided into halves, and of the glossy subglobose seeds, are frequently found in prehistoric graves of the coast tribes of Peru, and facsimiles of the fr. in the form of terra-cotta vases are also dug up with Peruvian mummies. *L. Palmeri*, Fern., is listed in S. Calif.: shrub, to 10 ft., with reddish brown bark on young branches: lvs. dark green, oblanceolate or narrow-obovate: fls. in 2's or 3's or solitary, the corolla twice as long as calyx; stamens and staminodia inserted at top of corolla-tube: fr. over 1 in. long, yellow. Mex. *L. salicifolia*, HBK., has proved hardy at Santa Barbara: lvs. 5-7 in. long and 1 in. wide, lanceolate, somewhat acuminate, entire and shining: fls. yellowish green, in 2's or 3's, axillary; ovary hirsute, ovate; style about equaling the corolla. Mex. *L. Sellowii*, A. DC. Lvs. linear or linear-lanceolate, acute, entire or somewhat repand, shining, the young ones tomentose: fls. on solitary or twin axillary pedicels, the corolla tubular, the calyx-lobes and corolla-lobes 4; drupe oblong, size of a pigeon's egg, beaked. Brazil. R.H. 1900, pp. 33, 34.

The most important member of the genus is without doubt *L. mammosa*, the mamey sapote, a common fruit in Cuba, and not infrequently seen on the Central American mainland. It can be grown in extreme south Florida, though it does not seem to thrive on shallow calcareous soils. California has so far proved too cool for it, and no trees of any size are known in the state. It is said to prefer a deep, rich soil and a rainfall of

about 70 inches per annum. The fruit is commonly elliptical, and about 6 inches in length. Within the thick woody skin, somewhat rough and rusty brown on the surface, is the soft melting flesh, of a beautiful reddish salmon color, and of about the same consistency as a ripe canteloupe. The large elliptical seed can be lifted out of the fruit as easily as that of an avocado; it



2214. The Ti-es.—*Lucuma nervosa*. (×4)

is hard, brown and shining, except on the ventral surface, which is whitish and somewhat rough. To one unaccustomed to tropical fruits, the flavor of the mamey sapote is at first somewhat cloying because of its utter lack of acidity; when made into a sherbet, however, as is done in Havana, it is delicious and sure to be relished at first trial. Although natives of tropical countries commonly eat the fruit while fresh, it is also made into marmalade, or used as a "filler" in making guava cheese. The Cubans prepare from it a thick jam, known as *crēma de mamey colorado*, which is delicious. The fruits are picked when mature, and laid away in a cool place to ripen, which takes about a week. If shipped as soon as picked from the tree they can be sent to northern markets without difficulty, and are occasionally exported from Cuba and Mexico to the United States. The season of ripening is during the summer; in Costa Rica the tree is said to lose its foliage in the dry season, flowering at the same time. The seed contains a large oily kernel, which has a strong smell and a bitter taste. According to Pittier, it is used in Costa Rica, after being finely ground, to prepare an exquisite confection; the same authority states that it is sometimes used by the Indians, after being boiled, roasted and ground, to mix with cacao, imparting a bitter taste to the beverage. The foliage of the mamey sapote resembles that of the loquat (*Eriobotrya japonica*), except in its lighter color and entire margins. Propagation is by seed, young trees coming into bearing at the age of five to seven years. Before planting it is well to remove the hard outer husk from the seed; it is then easily germinated by planting in light, sandy loam, barely covering it with soil.

The ti-es (*L. nervosa*) is esteemed in Cuba, where it is called canistel, and is also popular among many of the residents of southern Florida. It is too tender to be grown in California, unless in the most sheltered locations. Unlike the mamey sapote, the tree succeeds on thin poor soils, and seems to be at home on the Florida keys. Its season, in Florida, is from December to March. The fruits when ripe are broadly oval to round, orange-yellow in color, commonly about 3 inches in

length, and produced upon short stems toward the ends of the branches. The flesh is dry and sometimes mealy in texture, bright orange-yellow, often likened to the yolk of a hard-boiled egg, which it greatly resembles in appearance but not in taste. The flavor is sweet and rather cloying, to the novice at least, while the aroma is peculiar and somewhat musky. The seeds are one to three in number, oval, about an inch in length, hard, dark brown and shining, except on the ventral surface, which is dull, pale brown. The fruits usually require several days to soften after being picked from the tree, and as the skin is soft and delicate they do not ship so well as those of the mamey sapote. This species is not put to many different uses, the fruit usually being eaten while fresh. The tree is ornamental in appearance, with bright green, glossy foliage, and rarely grows to a height of more than 20 feet. It is usually propagated by seeds, young plants requiring three to five years to come into bearing. The hard outer husk should be removed from the seed before planting.

The abiu of tropical Brazil (*L. Caimito*), greatly resembles the ti-es in growth and foliage, but is easily distinguished by its light yellow fruit, with translucent, whitish, rather juicy flesh, of less cloying flavor than that of the ti-es. The abiu is very popular among the Brazilians, and is commonly cultivated at Rio de Janeiro, Bahia, and other points along the coast. The fruits vary from 2 to 4 inches in length, are usually ovate in form, and have a thick, closely adhering skin, within which lies the soft and melting flesh and two or three large oval seeds. It must be fully ripe to be appreciated; if cut while still firm, a milky latex exudes which is sticky and objectionable in the mouth, while the fruit has a strong taste of tannin. The same is true of other species. The tree, called *abiro* in Portuguese, thrives on a rich clay loam, with an abundance of moisture, and is propagated by seed.

Little has been done to improve any of the lueumas. There is much variation among seedlings, not only in size and quality of fruit, but in productiveness and other characters as well. The best ones should be selected and propagated by some vegetative means, such as budding.

F. W. POPEOE.

LUDDDEMÁNIA: *Lueddemannia*.

LUDWÍGIA (C. G. Ludwig, botanist and botanical author at Leipzig, 1709-1773). Sometimes spelled *Ludvigia*. *Onagraceæ*. Herbs, listed among aquaticas.

Annual or perennial aquatic or semi-aquatic small herbs: fls. small and inconspicuous in the axils of the lvs., the parts usually in 4's: fr. a terete ribbed or winged caps.: lvs. mostly small and entire or very nearly so, usually not distinctly petioled, alternate or opposite, the opposite-lvs. species by some referred to *Isnardia*.—Species about 25, widely spread in warm and temperate regions. The sts. are often creeping, sometimes floating. The ludwigias have little standing as horticultural subjects. They are sometimes useful in bog-gardens, and one is advertised for aquaria. Three names are in the American trade.

A. *Lvs. alternate*.

alternifolia, Linn. **SEED-BOX**, or **RATTLE-BOX**. An erect shrub, 2-3 ft. or more tall, in appearance not unlike an epilobium, the root sometimes tuberous: lvs. lanceolate or oblong-lanceolate, narrowed below, entire or sometimes with mere suggestions of teeth: fls. large for the genus ($\frac{1}{2}$ in. across), with yellow caducous petals: caps. large, square in cross-section. Bogs and wet woods in eastern half of U. S.—Interesting, but not showy.

A. *Lvs. opposite*.

palustris, Ell. (*Isnardia palustris*, Linn.). **WATER PERSLAE**. Trailing in muddy places or floating on shallow water, rooting at the joints: lvs. oval or oval-

oblong, narrowed into a short petiole: fls. very small, usually reddish.—Nova Scotia to Calif. and Mex.; Eu., Asia; offered as a bog-plant.

Mulertii, Mulertt. Lvs. oval to lance-oblong, narrowed into short petioles, entire: fls. yellow: fr. oblong, truncate on top, $\frac{3}{4}$ in. long.—Intro. from S. Amer. by Hugo Mulertt, then of Cincinnati, and described in "Isis" (published in Germany) in 1880 or 1881, and also in the "Aquarium," Vol. III, pp. 43, 64. It is now widely distributed amongst growers of aquarium plants. It seems not to have been studied by systematic botanists. It is prized for its graceful habit and because it is evergreen. Grows well from cuttings and from seeds. Mulertt, now residing in Germany, gives the following additional information: From the soil coming with rhizomes of nymphaea from the Amazon Valley in 1878 this ludwigia made its appearance. At first the plants were not considered to be unusual, but it soon became a favorite with eustomers, and it has now been widely distributed among aquarists. In Germany, where it is now frequently prop. from seed, several varieties have appeared, but although they retain the evergreen character they do not develop the graceful shape and brilliant crimson coloring of the foliage of the type. "The plant wants a shady location with a high temperature in a water-depth of about 15-18 in. to display its full character below the water-surface. In a sunny location, during summer, it grows above water, the foliage then displaying glossy dark brownish green on top and crimson-purple (or violet-crimson) below. Yellow flowers soon appear in the axils of the lvs. and develop into little caps. that bear the seeds. If left in the caps., these retain life for 6 or 8 years."

L. H. B.

LUEDDEMÁNIA (Herr Lueddemann). *Orchidaceæ*. A small group of S. American orchids, allied to *Cynoches*, but resembling *Acineta* in habit and requiring treatment similar to the acinetas: sepals oblong and acute, arched; petals cuneate-oblong and acute; ovary pubescent or velvety; fls. handsome, very many on a pendulous peduncle.

L. Lohmannii, Reichb. f. (*Cynoches Lehmannii*, Reichb. f.). Lvs. long and petioled, acute; pseudobulbs furrowed, pyriform, 6 or 7 in. long: fls. 20-30, wax-like, orange-yellow; sepals copper-colored on exterior. Colombia.—*L. Pescatorei*, Reichb. f. (*Cynoches Pescatorei*, Lindl. & Paxt.). Lvs. lanceolate, glaucous, leathery: fls. 30-50, about 1 $\frac{3}{4}$ in. diam., sepals orange-brown; petals and lip deep yellow, the disk hairy; peduncle 3 ft. Colombia. B.M. 7123.—*L. Sanderiana*, Kränzl.—*Lacyna bicolor*.—*L. triloba*, Rolfe. Pseudobulbs and lvs. smaller than in two preceding, the lvs. about 1 ft. long and the ovoid pseudobulb about 2 $\frac{1}{2}$ in. long: fls. deep orange-yellow, the peduncle short (about 6 in.); lip marked with chocolate-red; sepals with a crimson flush. Andes.—*L. Viperæna*, Schlecht. Allied to *L. Pescatorei*, but lip with a longer claw and different shape, with a smaller basal callus, and a less prominent thickening in middle of the blade. Peru.

L. H. B.

LUÈHEA (F. Karl van der Lühe, Austrian botanist interested in the Cape of Good Hope). *Tiliaceæ*. About 16 species of trees and tall shrubs from the warmer parts of Amer., with usually toothed lvs. and handsome white or rosy fls. borne in a terminal panicle, or sometimes in the axils: sepals and petals 5; stamens numerous, the outer ones often without anthers; ovary 5-celled: caps. rather woody, loculicidally semi-5-valved. A species was intro. into Santa Barbara, some years ago, from Paraguay. It is probably *L. divaricata*, Mart., with lvs. oblong or elliptic to oblong-lanceolate, irregularly serrate, grayish beneath. Luehea is also spelled Luhea, and the genus of this name of the Verbenaceæ is a S. African group referred to Stilbe.

LUËTKEA (after Fr. Luetke, Russian sea captain, in charge of the fourth Russian voyage around the world). Syn. *Eriogynia*. *Rosaceæ*. A prostrate and trailing undershrub, forming dense carpets, with ascending flowering shoots 2-6 in. high, small alternate trifid lvs. and small white fls. in upright racemes. It is closely

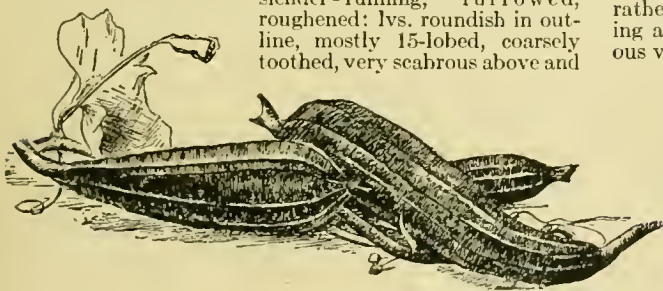
related to *Spiraea*, but differs in its habit, the 3-cleft lvs., in the carpels being dehiscent on both sutures and in the stamens being connate at the base. It is best adapted for rockeries and to be treated like other alpine plants; it is rarely seen in cult. Prop. is by greenwood cuttings and division. The only species is *L. pectināta*, Kuntze (*Spiraea pectināta*, Torr. & Gray. *Eriogynia pectināta*, Hook.). Lvs. 3-cleft, with linear lobes trifid at the apex, bright green, with the petiole $\frac{1}{2}$ – $\frac{3}{4}$ in. long; racemes 1–2 in. long; fls. white, $\frac{1}{2}$ in. across. Alaska to Calif., in the high mountains. Bot. Gaz. 15:241, pl. 14. Hooker, Fl. Bor. Am. 88.

ALFRED REHDER.

LÚFFA (*luff* is the Arabic name). *Cucurbitācea*. RAG GOURD. DISH-CLOTH GOURD. VEGETABLE SPONGE. About 8 species of annual tendril-climbing herbs, inhabiting the tropics of the Old and New Worlds, mostly in the former. Lvs. 5–7-lobed; tendrils simple or multifid; fls. monœcious or diœcious, the staminate ones in a long-stalked raceme or cluster, the pistillate solitary and shorter-peduncled; calyx bell-shape or top-shape, strongly 5-lobed; corolla of 5 soft yellow or whitish petals, sometimes ragged-edged; stamens usually 3, borne in the calyx-tube; fr. a long, gourd-like, 3-celled pepo, becoming dry when ripe and the fibrous interior sponge-like. In the South it has been called "California okra."

The luffas have come into more or less prominence in American gardens, being an importation from the tropics, and China and Japan. In other countries, the fruit is eaten when young, being cooked like squash or served in soups and stews. The young fruit is sometimes sliced and dried. (See Georgeson, A. G., Sept., 1892, and Bailey, Bull. 67, Cornell Exp. Sta.) In this country, luffas are grown mostly for curiosity and ornament. The fibrous interior of the dried fruit, when bleached and prepared, is used as a sponge for the bath and for scrubbing (whence "vegetable sponge"). The culture is the same as for cucumbers and melons. They are tender plants, running 10 to 15 feet. The luffas are widely dispersed in the tropics as cultivated plants. The genus divides itself into two groups,—those species (*L. cylindrica* and *L. acutangula*) with fruits not spiny or tuberculate, and those with spiny fruits.

cylindrica, Roem. (*Momordica cylindrica*, Linn. *L. ægyptiaca*, Mill. *L. Petola*, Ser. *L. Veitchii*, Naudin. *L. fétida*, Hort. [at least in part], not Cav. *L. Fabiāna*, L. *japonica*, L. *mexicana* [?] and *L. noctiflora alba*, Hort.). NAGA ITOURI of Japanese. SUA-KWA of Chinese. The commonest dishcloth gourd: sts. slender-running, furrowed, roughened; lvs. roundish in outline, mostly 15-lobed, coarsely toothed, very scabrous above and



2215. *Luffa acutangula*. ($\times \frac{1}{2}$)

beneath; staminate fls. 2–3 in. across, wilting in the sun; ovary cylindrical or clavate, pubescent, destitute of distinct ridges, ripening into a slender cylindrical curved fr. 1–2 ft. long; seeds black or rarely whitish, narrow-winged. A var. *macrocarpa* is listed. Probably native to the Old World, but widely distributed in the tropics. A.G. 13:526.

acutangula, Roxbg. (*L. fétida*, Cav.). SING-KWA of Chinese. Fig. 2215. Lvs. rounded, scarcely lobed, very

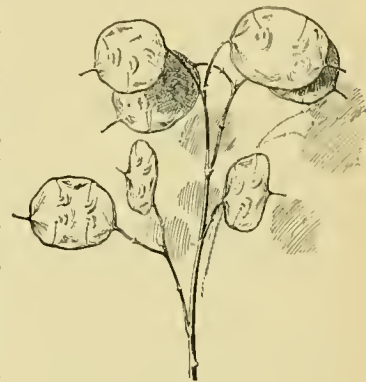
coarsely toothed; ovary 10-ribbed, ripening into a strongly ribbed fr.; seeds black and wingless. Tropics, probably indigenous in Asia. B.M. 1638. Gt. 48, p. 136.

L. H. B.

LUÍSIA (after Don Luis de Torres, Spanish botanist). *Orchidācea*. Curious epiphytic orchids, grown indoors.

Stems with simple or branched erect sts. bearing alternate, elongated, fleshy-terete lvs.: fls. sessile, on short lateral spikes; sepals and petals sub-similar, connivent or half-spreading; labellum adnate to the column, somewhat concave, with small lateral lobes and a large, spreading, entire or bifid middle lobe; column short; pollinia 2, on a broad, short pedicel. —About 20 species in Trop. Asia, the Malay Archipelago, and Japan. These plants are rarely cult.

They grow well in any warm or intermediate house, requiring the treatment given to aërides. A few of the species are listed by orchid specialists, but are not in the general popular trade.



2216. *Lunaria annua*. ($\times \frac{1}{4}$)

L. Amesiana, Rolfe. Habit of *Vanda teres*: fls. rather large, in clusters at sides of st.; sepals and petals pale yellow, brown outside; lip white, shaded yellow and spotted purple. India. G.C. III, 14:32.—*L. burmanica*, Lindl.=*L. teretifolia*.—*L. platyglossa*, Reichb. f.=*L. teretifolia*.—*L. Psyche*, Reichb. f. Sts. erect: lvs. about 6 in. long, quill-like. fls. axillary, in 2's; sepals and petals green; lip marked with deep purple. Burma. B.M. 5558.—*L. teretifolia*, Blume (*L. burmanica*, Lindl. *L. platyglossa*, Reichb. f. *L. zeylanica*, Lindl.). Stout, often producing very many downy roots: fls. small, chocolate-brown, in few-fl. clusters; petals and sepals sometimes whitish; lip convex, oblong. Burma. B.M. 3648 (as *Cymbidium triste*).

L. H. B.†

LUNARIA (*luna*, Latin for moon; name referring to the silvery white partition of the large pods). *Cruciferae*. SATIN FLOWER. MOONWORT. HONESTY. Herbaceous perennials and annuals, natives of Europe and western Asia, of two species, both of which are cultivated in old gardens.

Leaves rather large, simple, broad or more or less cordate: fls. purple, in terminal racemes or panicles, rather large and showy; fr. stalked in the calyx, becoming a very large flat disk-shaped silicle, with deciduous valves and a thin persistent septum; seeds winged, 2–4 in each compartment.—The plants are of easy cult. under any ordinary garden conditions. They are interesting for their showy fls., but are grown mostly for their great flat pods, which are used in winter bouquets. They are called "honesty" because the seeds can be seen through the pods. Prop. by seeds; or the second species rarely by division. The species sometimes escape from gardens for the seed readily self-sows.

annua, Linn. (*L. biennis*, Moench). Fig. 2216. Loose-hairy plant, $1\frac{1}{2}$ – $2\frac{1}{2}$ ft. tall, branching as it matures: lvs. somewhat cordate or halberd-cordate, coarsely and irregularly toothed, stalked: fls. numerous, pink-purple, fragrant, in May and June: pods about 2 in. long and somewhat narrower, very flat, rounded at the ends, tipped with the persistent style, interesting. Eu. R.H. 1857, p. 30.—Frequent in old-fashioned gardens; especially useful in sandy damp places, even in shady spots. There is a recent form with handsomely variegated lvs. Var. *corcyrensis*, Hort., has blue fls. Corfu. There is a white variety which is

much admired, since the fls. do not possess the bright color of the type species which is objectionable to many persons.

rediviva, Linn. Differs from the last in being perennial, the fls. usually larger and lighter colored (often grayish purple), May and June, and the pod elliptic or lance-elliptic, and tapering to either end: $1\frac{1}{2}$ – $7\frac{1}{2}$ ft. tall. Eu.—Less common and less valuable than *L. annua*. Thrives best in partial shade.

L. H. B.

A. C. HOTTES,†

LUPINUS (from the Latin *lupus*, a wolf, because a crop of lupines was supposed to destroy fertility). *Leguminosæ*. *LURINE*. Usually herbs adapted to borders in masses, and to all places in which low-growing showy herbs would be found; some make good bedding-plants, others cut-flowers.

Mostly annuals or herbaceous perennials, 2 species in cult. being shrubby: lvs. usually digitate, with 5–15 entire lfts.: fls. with calyx deeply bilabiate, 5-toothed, unequal; corolla with simple erect broadly ovate standard, having strongly reflexed sides; wings united at the apex and inclosing the keel; stamens united into a closed tube: pod 2-valved, flattened, inclosing several large seeds.—A group of about 300 species mostly confined to W. N. Amer., a few growing in E. N. Amer., Peru, Brazil, Mex., Guatemala, Afr., and in the Medit. region. A very variable genus in the garden. There are numerous garden hybrids of unknown parentage. Some of these names will be found in the supplementary list. Voss groups these under the name of *L. hybridus*, Hort., and its vars. *atrococcineus* and *roscus*, or florists' lupines. They have variegated fls.

In addition to those described below the following native species have been advertised, mostly by Gillett, in 1881, for western collections. Probably they are not in cultivation. They are mostly described in Bot. Calif.: *L. albicaulis*, *L. Chamissonis*, *L. lepidus*, *L. leucophyllus*, *L. ornatus* and *L. villosus*.

The lupines are showy plants with conspicuous flowers in terminal racemes, those of the species in cultivation being mostly verticillate. The flowers are blue, white or yellow, or a union of these, papilionaceous and free-blooming. All are of easy cultivation in any garden soil, except that they are said not to succeed in soil containing lime. They are propagated by seed, the perennials also by division. They do not bear transplanting when once established, hence it is recommended to sow seed where the plants are finally desired. A few species are of value economically for soiling or plowing under.

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KEY TO THE SPECIES.

A. Perennials.

B. Plants shrubby.

c. Shrub tall, 4–10 ft. 1. **arboreus**

cc. Shrub dwarf, $1\frac{1}{2}$ ft. 2. **densiflorus**

BB. Plants herbaceous.

c. Lvs. with 1 lft. 3. **diffusus**

cc. Lvs. with several lfts., digitate.

b. Foliage not conspicuously hairy above.

e. Number of lfts. 5–9.

f. Lfts. shorter than petioles.

g. Pod $\frac{1}{2}$ in. long. 4. **perennis**

gg. Pod $\frac{3}{4}$ in. long. 5. **parviflorus**

- ff. Lfts. as long as petioles. 6. **argenteus**
 ee. Number of lfts. 7–9. 7. **rivularis**
 eee. Number of lfts. 10–16. 8. **polyphyllus**
 dd. Foliage conspicuously hairy or silky above.
 e. Fls. parti-colored, striped. 9. **nootkatensis**
 ee. Fls. light blue, with a dark spot on the standard. 10. **plattensis**

AA. Annuals.

b. Fls. yellow.

c. Number of lfts. 13–15. 11. **sulphureus**

cc. Number of lfts. 7–10. 12. **luteus**

bd. Fls. blue, white or red, but self-colored.

c. Arrangement of fls. in whorls.

d. Number of lfts. 9–11. 13. **pilosus**

dd. Number of lfts. 5–7.

e. Plant villous. 14. **micranthus**

ee. Plant merely puberulent. 15. **affinis**

cc. Arrangement of fls. scattered.

d. Lfts. hairy on both sides. 16. **hirsutus**

dd. Lfts. with rigid stinging hairs. 17. **hirsutissimus**

ddd. Lfts. not hairy above.

e. Color of fls. white. 18. **albus**

ee. Color of fls. blue. 19. **pusillus**

bbb. Fls. of 2 or more colors.

c. Foliage hairy on both sides. 20. **Hartwegii**

cc. Foliage not conspicuously hairy above.

d. Height about 5 ft. 21. **mutabilis**

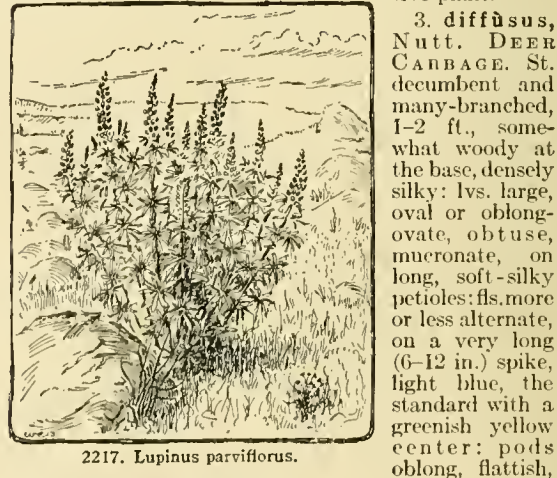
dd. Height 1 ft. or less.

e. Arrangement of fls. alternate. 22. **subcarnosus**

ee. Arrangement of fls. whorled. 23. **nanus**

1. **arboreus**, Sims. **TREE LUPINE**. Lfts. 7–11, lanceolate-linear, acute, silvery downy below, entire; fls. somewhat verticillate, in tall, loose racemes, sulfur-yellow, fragrant: pods pubescent, $1\frac{1}{2}$ –3 in. long. July–Sept. Common in Calif. B.M. 682. Gn. 30, p. 289; 47:398. —Shrub, 4–10 ft. high, somewhat pubescent, not hardy at the north. Var. *Snow Queen* or *Queen of the Snow* is pure white. Var. *luteus* has been advertised.

2. **densiflorus**, Benth. (*L. Menziesii*, Agardh). A dwarf shrub, 18 in. tall with long hairy lf.-stalks and handsome compound lvs.: fls. in a long dense raceme, deep yellow, large. Calif. B.M. 5019.—A very attractive plant.



2217. *Lupinus parviflorus*.

very woolly. April. Sandy barrens, N. C. to Fla.—Hardiness N. not determined.

4. **perennis**, Linn. **SUN-DIAL**. **COMMON WILD LUPINE**. St. erect, 1–2 ft. high, rather stout, minutely pubescent: lvs. long-petioled, soft-downy; lfts. 7–9, obovate-oblong to lanceolate, obtuse, glabrous above, soft-downy below; fls. in large, loose terminal spikes or racemes, alternate, blue, varying to white. June, July. Canada to Fla. B.M. 202. Mn. 6:101. B.B. 2:269.—

Desirable species, growing in the poorest soil, preferring sandy land. Grows from subterranean rootstocks.

5. *parviflorus*, Nutt. Fig. 2217. Fls. light blue, smaller than in *L. perennis*; lfts. 5-11, broad-linear to oblanceolate. N. Mex. to Wash.

6. *argenteus*, Pursh. Fls. blue or cream-colored; lfts. 5-8, linear-lanceolate. W. N. Amer. B.B. 2:269. Var. *roseus*, Hort. Fls. rosy-pink, lower half slightly paler. Suitable for herbaceous border.

7. *rivularis*, Douglas (*L. cytisoides*, Agardh). Perennial, 4-6 ft. high: sts. stout; lvs. large and handsome; lfts. 7-9, oblanceolate; fls. deep pink or rose-purple, in long racemes. W. N. Amer.

8. *polyphyllus*, Lindl. (*L. grandiflorus*, Lindl.). Stout, erect species, forming tufts 2-5 ft. high: lvs. distant, mostly radical, long-petioled; lfts. lanceolate, glabrate above, silky hairy below, 2-6 in. long; fls. on long stalks, alternate, pedicelled, deep blue; pod 1-1½ in. long, narrow. June-Sept. Wash. to Calif. Gn. 45, p. 459; 55, p. 215.—A common garden species of merit, succeeding in any good soil. Var. *Möerheimii*, Hort. A very beautiful new intro. from the firm of B. Ruys at Dedemsvaart in 1906-7. Two to 3 ft. tall, much more compact and erect than the true *polyphyllus* forms: fls. long-lived, bright pink, rose to white. Without doubt it is the best variety which exists. R.B. 37:225; 38:217. G.M. 51:613. Var. *albiflorus*, Hort. (var. *albus*), is white, bold and showy. Var. *bicolor*, Hort., is variegated blue and white. Var. *Föxei* is uncertain.

9. *nootkatensis*, Donn. St. hairy, decumbent, with long, spreading hairs, 2-3 ft. high: lfts. 5-9, narrowly obovate-oblong, smooth above, hairy below, mucronate; stipules lanceolate, nearly as long as the lfts.: fls. in dense racemes, blue, variegated with red and yellow, with large veins, variable. May-July. Nootka Sound. B.M. 1311; 2136.—Coarse stocky species, said to be unsuitable for small gardens, but of merit.

10. *plattensis*, Wats. One to 1½ ft. high: lfts. 7-10, oblanceolate, spatulate or narrowly oval: raceme loosely fld., terminal; corolla blue, standard with a conspicuous dark spot. June, July. Neb., Wyo., Dak. B.B. (ed. 2) 2:348.

11. *sulphureus*, Douglas. St. very erect, white silky: lfts. narrowly lanceolate, densely hairy on both sides, shorter than the petiole: fls. in tall, dense racemes, sulfur-yellow: pods woolly, 1 in. long. July, Aug. Mountains of Ore. R.H. 1890:252.—Strong species branching above, bare below.

12. *luteus*, Linn. YELLOW LUPINE. Fig. 2218. St. erect, nearly simple, hairy, 2 ft. high: lfts. lanceolate, acute, hairy: fls. on pubescent stalks longer than the lvs., verticillate, yellow, fragrant; pod oblong, flat. June, July. S. Eu. B.M. 140.—Succeeds in the poorest soil. Useful for cut-fls., for the border, for fodder or for plowing under to improve sandy soils. As a fodder, it may be fed green or as hay.

13. *pilosus*, Linn. St. hairy, 2-4 ft. high: lfts. oblong-lanceolate, hairy: fls. verticillate, pedicelled, rose, the middle of the standard red. S. Eu.

14. *micranthus*, Douglas. St. slender, 3-12 in. high, hairy: lfts. linear, ¼-1 in. long: fls. in short, dense racemes, somewhat verticillate, very small, violet, standard and wings narrow: pod linear. Gravelly places, Ore. to Calif.—A slender plant of branching habit.

15. *affinis*, Agardh. St. rather stout, 8-10 in., pubescent very short: lfts. broadly wedge-obovate, obtuse, long, more or less smooth above; stipules one-half the length of lvs.; petioles twice longer than the lfts.: fls. on a long stalk, deep blue: pod linear. Early spring. Calif.—A free, hardy species, often growing very rank.

16. *hirsutus*, Linn. BLUE LUPINE. St. hairy, 2-3 ft. high, branching toward the top: lfts. 7-9, oblong or

oblong-oval, hairy, long-petioled: fls. somewhat verticillate or scattered, large, mostly purple, sometimes variegated with blue or violet: pod large, very hairy. July, Aug. S. Eu.—Used ornamentally and as an economic plant for the same purposes as *L. luteus*. It is valuable for fodder and for plowing under. Var. *albus*, Hort., has white fls. Var. *ruber*, Hort., and var. *foliis roseis* are advertised.



2218. *Lupinus luteus*.

17. *hirsutissimus*, Benth. Annual, 1½-2½ ft. high: sts. rather stout, covered with stiff hairs: lfts. 5-7, cuneate-obovate, on erect sts., quite large, very showy. Calif.

18. *albus*, Linn. WHITE LUPINE. Erect st., 1½ ft. high: lfts. obovate-oblong, 5-7, hairy below, 1½-2 in. long: fls. alternate stalked, on erect sts., quite large, white: pods large. Summer. Asia and S. Eu.—A good fodder plant said to be of greater thrift than *L. luteus*, and remaining green longer. Succeeds well on the poorest soil and is valuable for plowing under. Seeds are sown April-July, and the plants are plowed under when in flower.

19. *pusillus*, Pursh. Lfts. about 7, mainly oblong, acute: fls. blue or purple. Prairies. B.B. 2:270.

20. *Härtwegii*, Lindl. St. erect, 2-3 ft. high, somewhat branching: lfts. 7-9, oblong, obtuse, very hairy: fls. in many-fld. elongated racemes, blue; standard whitish, then reddish. June-Sept. Mex. B.R. 25:31. Var. *albus* is also sold. Possibly a perennial but cult. as an annual.

21. *mutabilis*, Sweet. St. erect, branched, somewhat woody, 5 ft. tall: lfts. 7-9, lanceolate, obtuse, hairy below and somewhat glaucous: fls. large, somewhat verticillate, fragrant; standard white mixed with blue, becoming blue with a large yellow mark in the center; wings and keel white. June-Aug. Mountains of S. Amer. B.M. 2682.—Attractive species, erect and branching but half-hardy.

Var. *Crückshanksii*, Hook. (*L. Crückshanksii*, Gray). Fls. large, fragrant, white, the standard yellow-rose, becoming violet. B.M. 3056.

22. *subcarnosus*, Hook. St. 8-10 in. high, ascending, silky pubescent: lfts. 5-7, obovate-lanceolate, obtuse, somewhat fleshy, smooth above, silky below and on margins: fls. in pyramidal racemes, alternate; standard orbicular, deep blue with a white spot in the center divided by a longitudinal fold: pod linear-oblong, silky. Spring. Texas. B.M. 3467.—Spreading species of merit.

23. *nanus*, Douglas. St. slender, ½-1 ft., often branching from the base, hairy: lfts. 5-7, linear to oblanceolate, pointed, pubescent both sides, stalks 1-3 times longer: fls. in elongated, loose racemes, verticillate on slender stalks, large, white, pointed with clear blue, edged with deeper blue; wings bluish, hiding white-

brownish keel; pod hairy. June, July. Calif. B.R. 1705.—This species and its varieties are very floriferous, giving a fine effect in masses and in the border. Var. *albus* Hort., white tinged with lilac. Var. *albo-coccineus*, Hort. A very compact variety, the lower half of the spike rosy red, the upper white; forms compact tufts and is called a superior variety.

L. angustifolius, Linn., with blue fls., is much grown in Eu. as a fodder plant and for plowing under: annual. Native to the Medit. region.—*L. pubescens*, Benth. Perennial or subshrubby, the pubescence short, spreading, hardly silky in the new parts: lfts. 7-9, oblong-lanceolate, acute, shorter than the petiole, pubescent on both sides: fls. loosely arranged almost in whorls; pedicels shorter than the calyx; pod hirsute, 4-6-seeded. The above is from the original description. Bentham neglects to state the color of the fls., but an allied species has blue fls. Mottet must be in error in calling this an annual. Mex., Cent. Amer., Colombia.—*L. villosus*, Willd., is mentioned occasionally in garden literature.

The following are garden hybrids of unknown origin. They mostly have variegated fls. and are common in cult.: *L. atrovirens*. Perennial, 2 ft. high: fls. dark violet, striped with white and yellow.—*L. calceolatus*. Annual, 2 ft. high: fls. light blue.—*L. Dunnettii*. Fls. lilac-purple, gold and white. According to Voss, this is the same as the kinds known to the trade as *L. superbus*, *L. insignis* (Vilmorin, not Dippel), *L. tricolor elegans* and *L. superbus Dunnettii*. There is also a double form.—*L. hybridus*. Probably mixed kinds.—*L. tricolor*. See *L. Dunnettii*.

A. PHELPS WYMAN.

JOHN W. HARSHBERGER.†

LÚZULA (Latin *luz*, light, in diminutive derivation, from some fanciful attribute or interest). *Juncaceæ*. WOOD RUSH. About forty species of grass-like or rush-like, often caespitose, perennial herbs of wide distribution in temperate and frigid regions, some of them adapted to borders and for colonizing. Several species are native in the United States and Canada, but none of them seems to be listed in the trade; two European species are offered abroad. By some, the name *Juncoides* is used in place of *Luzula*.

These are plants of mostly inconspicuous green or scarious fls. (sometimes white) in umbel-like, paniculate, corymbose or congested infl., the fls. always bracteolate; perianth parts distinct, glumaceous; stamens usually 6; ovary 1-celled: fr. a dry 3-seeded caps.: lvs. soft, usually hairy or webby; dry ground. *Juncus*, to which the genus is closely related, differs in its mostly 3-celled and many-seeded caps.

syliatica, Gaud. (*L. máxima*, DC. *L. sylvestris*, Hort. *Juncoides sylvaticum*, Kuntze). Rhizome woody: st. 12-18 in. or more high: lvs. linear-lanceolate, hairy-edged, shining, striate: panicle double-compound, much exceeding the lf-like bracts; perianth-segms. bristle-pointed; filaments very short. Eu.—There is a form with variegated (striped?) foliage.

nivea, DC. (*Juncoides nivum*, Kuntze). Fls. pure white, large, in thick panicles that are shorter than the lf-bracts; filaments about equalling the anthers: plant 12-18 in.: lvs. linear, hairy on margin. Eu., Alps.—Useful in dry bouquets.

L. H. B.

LYCÁSTE (fanciful name). *Orchidaceæ*. Epiphytic and terrestrial orchids; very popular as greenhouse subjects.

Pseudobulbs ovate or oblong-ovate, bearing 1 to several plicate lvs. at the summit, and sheathing lvs. from the base; sepals subsimilar, spreading, the lateral pair united with the base of the column and forming a spur-like chin or mentum; petals smaller, projecting forward, with the tips often recurved; labellum 3-lobed, the lateral lobes erect, middle lobe ascending or recurved, with a fleshy, tongue-like callus on the disk; pollinia 4.—About 30 species, all natives of S. Amer., Mex., and the W. Indies. The fls. are freely produced and remain in good condition on the plant for several weeks. They are normally borne singly on erect or sub-erect bracted scapes, but sometimes twin-fl. stalks occur. In *Lycaste* the scape arises from the very young leafy axis, which does not develop until several months later. The scape, therefore, appears from the base of the bulb. Among the species, *L. Skinneri* is a favorite

orchid with growers. The species of *Lycaste* are very distinct from each other and do not fall readily into natural groups. The arrangement in the key is purely artificial, and does not indicate close relationship among the species grouped together.

The genus *Lycaste* is closely allied to *Maxillaria* and has a similar geographical range, being found from Mexico and the West Indies to Peru and southeastern Brazil. Notwithstanding this wide distribution, however, they readily subject themselves to one general mode of treatment, and may be grown in a bright cool portion of the cattleya or warm end of the odontoglossum department, where they should receive plenty of indirect solar light, moisture and sufficient ventilation to ensure an active atmosphere. During winter, the night temperature should range from 50° to 55° Fahr. and that of the day from 60° to 65°, or a few degrees higher, with sun heat and ventilation. In summer, the air should be as cool as possible, and contain plenty of moisture. When *lycastes* are growing they need a good supply of water at the roots, and should never be allowed to remain dry for a long time, even when at rest. Light syringing overhead is beneficial at all times in bright weather when air can be admitted. The deciduous species, however, must be carefully watered when at rest, for it must be remembered that in casting their foliage they lose most of their active radiating surface, thus reducing evaporation to a minimum.—For special treatment, they may be divided into three groups, *L. aromatica*, *L. costata* and *L. tetragona* forming good types. The *L. aromatica* section embraces, besides the type, *L. candida*, *L. cruenta*, *L. Deppei*, *L. lasioglossa*, *L. macrobulbon* and kindred sorts, all more or less deciduous. These grow best in pots in a mixture of equal parts chopped peat fiber and sphagnum moss, with a small quantity of leaf-mold added. About one-third of the pot space should be devoted to drainage of broken charcoal or potsherds, and the compost must be carefully and rather firmly pressed in about the roots, leaving the base of the pseudobulbs on a level with or a little below the rim of the pot. The best time for transplanting is just after the plants start into new growth, at which time give a more abundant supply of water.—The *L. costata* group includes, besides the type, such species as *L. lanipes*, *L. locusta* and *L. Skinneri*, which, excepting the last, are but semi-deciduous, large-growing species. They succeed best under pot culture, and should be grown in a compost of about equal parts chopped sod, from which some of the fine soil has been removed, and decomposed leaves, adding a little chopped live sphagnum to keep the soil porous and to retain moisture. The compost should become nearly dry occasionally to prevent it from becoming sour.—The *L. tetragona* section is small; all are sempervirent and grow best under basket culture in porous material consisting of chopped peat fiber and live sphagnum, well mixed and interspersed with nodules of charcoal. The compost should be pressed in moderately firm about the roots to keep the plant steady, and newly imported pieces should be held in place by copper or brass wire crossed between the pseudobulbs.—*Lycaste* stock is usually supplied by new importations, but plants may be increased by cutting through the rhizome between the pseudobulbs, two at least being left to each piece. (Robert M. Grey.)

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L. cristata = *Paphinia cristata*.—*L. Harrissonia* = *Bifrenaria*.—*L. inodora*, Lindl. = *Bifrenaria*.—*L. jugosa*, Benth. = *Colax*.

KEY TO THE SPECIES.

- A. Middle lobe of lip semi-oblong or rounded, usually obtuse or truncate.
 B. Lip pilose with long hairs. 1. *lasioglossa*
 BB. Lip glabrous or short-pubescent.
 C. Fls. white, sometimes green-tinged (some white forms of *L. Skinneri* might be sought here).
 D. Sepals ivory-white; disk-plate grooved and emarginate. 2. *costata*
 DD. Sepals greenish white; disk-plate with 3-5 parallel raised lines. 3. *lanipes*
 CC. Fls. not entirely white.
 D. Petal white.
 E. Sepals oblong, but little longer than petals.
 F. Front lobe of lip entire; sepals pale green. 4. *candida*
 FF. Front lobe of lip denticulate; sepals olive. 5. *plana*
 EE. Sepals lanceolate, much longer than petals. 6. *Schilleriana*
 DD. Petals not white.
 E. The lip toothed or fringed.
 F. Sepals and petals olive, much longer than the maroon orange-bordered lip. 7. *gigantea*
 FF. Sepals and petals dull green, about as long as the green white-bordered lip. 8. *locusta*
 EE. The lip entire.
 F. Size of fls. 3 in. across or less; sepals yellowish green.
 G. Sepals and petals streaked with red-brown; lip white. 9. *tetragona*
 GG. Sepals and petals not marked; lip yellow.
 H. Base of lip blood-red; front lobe quadrate. 10. *cruenta*
 HH. Base of lip yellow; front lobe oblong-ovate. 11. *macrobulbon*
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 AA. Middle lobe of lip spatulate. 13. *aromatica*
 AAA. Middle lobe of lip ovate-acuminate. 14. *Deppei*

1. *lasioglossa*, Reichb. f. Pseudobulbs 3 in. long, ovoid, compressed; lvs. 8-12 in. long, elliptic-lanceolate; scape 1-fld.; fls. 5 in. across; sepals spreading, narrowly oblong, dull brown or greenish brown; petals one-third as long, erect, concave, obtuse, golden yellow; labellum as long as the petals, also golden yellow; lateral lobes short, obtuse; middle lobe oblong, covered with long, soft hairs; callus ovate, notched. Autumn and winter. Guatemala. B.M. 6251. G.M. 44:179.—Very odd but not showy.

2. *costata*, Pseudobulbs oblong, compressed, 3-5 in. long; lvs. 2-3 at the apex, 6-10 in. long, broadly oblong-lanceolate, acuminate; scape erect, as long as the pseudobulb; fls. large, nearly white or creamy yellow; dorsal sepals oblong-lanceolate, the lateral sepal similar but falcate, united with the column to form a blunt spur; petals smaller, somewhat undulate; lateral lobes of the labellum small, erect; middle lobe ovate-rotund, toothed. Peru. B.M. 5706 (as *L. Barringtonia* var. *grandiflora*). J.H. III. 42:5. C.O. 10.

3. *lanipes*, Lindl. Pseudobulbs large; lvs. lanceolate, 12-18 in. long; fls. solitary, as many as 15 on a plant, creamy white; sepals and petals oblong-lanceolate; labellum smooth; lateral lobes ovate-obtuse; middle lobe oblong, obtuse, serrate, with a concave, ribbed callus. Oct. Ecuador.—Lindley says the fls. are pale green, 2½ in. long before they expand, without a trace of any other color.

4. *candida*, Lindl. (*L. brevispatha*, Klotzsch). Pseudobulbs ovoid, much compressed; lvs. oblong-acuminate; fls. about 2 in. across; sepals spreading, reflexed and acute at the apices, oblong, slightly woolly at base, yellowish green, sometimes dotted with light rose; petals whitish, revolute, obtuse; labellum white, with a few rose-colored spots; disk-plate obtuse, emarginate at the apex; column hairy on the inner surface. Costa Rica. C.O. 6. Var. *Lawrenceana*, Hort. Sepals and petals tinted with rose, otherwise the fls. are like those of the type. Var. *rùbra* has been offered.

5. *plana*, Lindl. A robust plant, with large ribbed pseudobulbs and ample-pointed oval lvs.: fls. 3-4 in. across; sepals oblong, plane, rich madder-red inside; petals smaller, with recurved tips, white, tipped with crimson; labellum smaller, white spotted with crimson; side lobes crenulate; middle lobe rounded, obtuse, serrate, crested. Winter. Bolivia. B.R. 29:35. Var. *Measuresiana*, Williams. Sepals reddish brown, tipped with green; petals and labellum white spotted with bright rose, except on the margins of the petals. Autumn.

6. *Schilleriana*, Reichb. f. Plant resembling *L. Skinneri* in habit: pseudobulbs 2-lvd.: lvs. elongate-lanceolate, up to 2 ft. long; scape 1-fld., suberect, 8 in. long; sepals large, spreading, oblong-lanceolate, 4 in. long, brown; petals erect, with recurved tips, small, 1½ in. long, white, speckled with brown on the back; labellum as long as the petals, white, speckled and tinged with rose; side lobes small; middle lobe ovate-quadrate, crenulate; callus tongue-shaped, concave. Often the parts of the fl. are more or less spotted and hairy in places. July, Aug. Colombia. Gt. 39:1321. Var. *magnifica*, Hort. Sepals long, olive-tinted; petals and lip white.

7. *gigantea*, Lindl. Pseudobulbs often 6 in. high, bearing 2-3 oblong-lanceolate lvs. 1½-2 ft. long; scape 1-fld., somewhat shorter than the lvs.; sepals ovate to lanceolate, 3 in. long, rather olive-green; petals somewhat smaller, lanceolate, spreading, of the same color; labellum oblong-lanceolate; side lobes acute; middle lobe ovate, acuminate, serrate, rich maroon bordered with a narrow orange margin; crest fleshy, emarginate. The fl.-sts. are said to attain a height of 2 ft., with a single large fl. In most of the specimens in cult. the lip is abruptly rounded off. June-Aug.; Nov., Dec. Widely dispersed in Cent. Amer. B.M. 5616. B.R. 31:34. C.O. 7.

8. *locusta*, Reichb. f. Pseudobulbs pyriform: lvs. oblong-ligulate, acute; fls. smaller than those of *L. Deppei*, all green except the white column; the odd sepal oblong, obtuse; the lateral ones linear-oblong, acute; petals bent down inside of the lateral sepal; labellum with acute side lobes and a semi-oblong, fleshy, convex middle lobe, all green; on the disk are 2 narrow keels, confluent behind into a fleshy emarginate callus. Peru. B.M. 8020. G.C. III. 49:260.

9. *tetragona*, Lindl. Pseudobulbs ovate, tetragonal: lvs. solitary, ovate-lanceolate; scape 1-4 fld.; fls. greenish streaked with crimson; sepals and petals oblong-ovate, rather obtuse, half-spreading, the 2 lower forming a blunt, projecting angle at base; labellum smaller, white and purple or green and purple, with a shovel-shaped appendage on the disk. Fls. not beautiful, but very fragrant, remaining fresh for two months. June. Brazil. B.M. 3146 and B.R. 1428 (both as *Marillaria tetragona*).

10. *cruenta*, Lindl. Pseudobulbs compressed; lvs. many, oblong, membranaceous; scape bearing 1 yellow fl. (rarely 2), much larger than those of *L. aromatica*; sepals ovate, obtuse; petals similar, erect and smaller; labellum half as long as the sepals; lateral lobes rounded; middle lobe rounded-truncate, crisp on the margin, pubescent; crest small, fleshy. Like *L. aromatica*, but the lvs. much broader, fls. larger, and the labellum of different shape and somewhat spotted with purple.

March, April. Guatemala. B.R. 28:13 (as *Maxillaria cruenta*). Gn. 44:394 (as *L. aromatica*). C.O. 9.

11. *macrobulbon*, Lindl. Pseudobulbs very large, ovate, compressed, with several large, oblong, acute lvs.: scapes usually 2 from each pseudobulb, much shorter than the lvs.; fls. large, yellow; sepals ovate-oblong, spreading; petals shorter, somewhat concave, with recurved tips; labellum oblong, as long as the petals, spotted on the disk with brown. Colombia. B.M. 4228 (as *Maxillaria macrobulbon*).

12. *Skinneri*, Lindl. Pseudobulbs oblong-ovate, 3-5 in. high, 1-2-lvd.: lvs. oblong-lanceolate, 9-12 in. long; scapes 5-6 in. long, each bearing a single waxy fl. 5-6 in. diam.; sepals ovate-oblong, white tinged with rose; petals half as long, broadly ovate, pointing forward with acute, reflexed tips, striated and tinged with dark rose; lateral lobes of the labellum erect truncate; middle lobe oblong-ovate, recurved with a fleshy tongue-shaped callus on the disk, dark crimson-purple. Guatemala. B.M. 4415. P.M. 11:1. Gn. 25:410; 30, p. 374; 37:397. F. 1861:65 (var.). A.F. 4:519. J.H. III. 34:367; 60:321. A.G. 14:433. C.L.A. 6:166. G.M. 53:894. C.O. I. O.R. 19:276.—The most useful of the genus. Spring. The following varieties are advertised:

Var. *alba*, Hort. A large-fl. white variety with a tinge of yellow at the base of the labellum and a yellow, tongue-shaped appendage in its throat. I.H. 27:405. Gn. 25:410. F.M. 1872:35. G.C. III. 7:424. A.F. 6:631. J.H. III. 50:253; 62:541. C.O. 1a O.R. 19:177. Var. *albo-sanguinea*. No description. Var. *armeniaca*, Hort. Sepals white; petals and lips suffused with apricot-yellow. G.M. 53:72. J.H. III. 60:51. C.O. 1d. Var. *candida*, Hort. White. Var. *delicatissima*, Hort. Fls. large, rose-white; labellum white, blotched with rose. Feb. C.O. 1b. Var. *Denholmiæna*, Hort. Upper lobes of fl. rich crimson; lip almost white. Var. *grandiflora*. No description. Var. *hellemense*, Cogn. Fls. bright rose-purple. C.O. 1e. R.B. 35:53. Var. *purpurata*, Hort. Sepals and petals rose-white; labellum crimson-purple. Var. *rosea*, Hort. A beautiful variety with deep rose fls. and a white labellum spotted with crimson. Var. *superba*. Sepals and petals white; labellum crimson.

13. *aromatica*, Lindl. Fig. 2219. Pseudobulbs ovate, compressed; lvs. many, sheathing, oblong-lanceolate; scape erect, 1-flid., shorter than the lvs.; fls. yellow, 2½ in. across; sepals and petals ovate-oblong, acute; the latter smaller and pointing forward; lateral lobes of the labellum with narrow, projecting blades; middle lobe spatulate, dentate, recurved, and having a large truncate plate as a crest. Winter and spring. Mex. B.R. 1871.—Floriferous.

14. *Déppeii*, Lindl. Pseudobulbs ovate, clustered; lvs. 3-4, broadly elliptic-lanceolate, 1½-2 ft. long; scape erect, bearing 1 or 2 fls. 4 in. diam.; sepals oblong-lanceolate, dingy green, spotted with chocolate-purple; petals smaller and cucullate, white; labellum bright yellow, with a few purple spots; lateral lobes small, rounded; middle lobe ovate-acuminate, recurved, waved, with a yellow callus. Vigorous and free-flowering. Aug. to May and June. B.M. 3395. L.B.C. 17:1612 (both as *Maxillaria Déppeii*). P.M. 2:268 (as *Maxillaria*

Déppeii). C.O. 11.—Named after Deppe, but originally spelled *Deppii*. Var. *punctatissima*, Hort. Fls. much spotted with dark purple. Guatemala.

L. Bällia = *L. Skinneri* × *L. plana* var. *Measuresiana*. Sepals terra-cotta with a rosy flush; petals rose, fading, to white at tips; lip white, irregularly carmine-spotted. O.R. 11:80. G.M. 46:356; 55:219.—*L. Barringtonia*, Lindl. Fls. green to tawny yellow; sepals and petals ovate-lanceolate; lip 3-lobed, the front lobe ovate; imbricate. W. Indies.—*L. Déppeii* = *L. Skinneri* × *L. plana*.—*L. Charlesworthii* (?).—*L. Dyeriana*, Sander. Fls. pale green; lip obscurely 3-lobed, the front lobe elliptic, denticulate, reflexed, obtuse. Peru. B.M. 8103.—*L. cisgrubensis* = *L. Skinneri* × *L. lasioglossa*.—*L. formosa* (?). Fls. large, cream-white, with red spots at the base of the petals.—*L. fulvescens*, Hook. Sepals and petals lanceolate, acuminate, red-brown, paler at base; lip orange-brown, oblong, obtuse. Colombia. B.M. 4193.—*L. Gröganii* = *L. aromatica* × *L. Déppeii*.—*L. Hennicæna*, Kränzl. Allied to *L. lasioglossa*. Fls. large; petals nearly white; lip quite glabrous, white or cream-colored; column pure white, hairy above the middle. Colombia.—*L. hybrida* = *L. Skinneri* × *L. Déppeii*. Fls. in size between the two parents, cream-color, minutely dark-spotted.—*L. Imshootiana*, Lind. & Cogn. = *L. Skinneri* × *Maxillaria nigrescens*. Sepals pale yellow, red-spotted; petals pale yellow, smaller, less spotted; lip yellow, dark purple at base. Lind. 410. J.H. III. 62:425.—*L. laia*, Rolfe. Allied to *L. Barringtonia*. Fls. white, except sepals and apex of petals which are green. Peru.—*L. Lucianiana* = *L. Skinneri* × *L. lasioglossa*.—*L. macrophylla*, Lindl. = *L. plana*.—*L. Micheliæna*, Cogn. In general aspect much resembling *L. aromatica*, but with the floral segms. broader. Mex.—*L. peruviana*, Rolfe. Sepals and petals light brown, becoming paler at base, lip nearly white. Peru.—*L. Pourbaixiana* = *L. Skinneri* var. *superba* × *L. Déppeii*.—*L. Rogersonii* = *L. Skinneri* × *L. plana*.—*L. tricolor*, Reicheb. t., var. *albescens*. Sepals pale green; petals white with greenish tinge at ends. —*L. Tünstlii* (?). Sepals rose-colored; petals white with rose-pink spots; lip ruby-red, with white markings. G.C. III. 54:415.—*L. ruyriophora*, Reicheb. Sepals light greenish brown, with a horny point on the under side; petals yellowish green at base, white above; lip small, white, sometimes stained rose-pink. Peru (?).

HEINRICH HASSELDÖRFF.
GEORGE V. NASH.



2219. *Lycaste aromatica*.

LÝCHNIS (from the Greek word for *lamp*, in allusion to the flame-colored fls. of some species). Including *Agrostemma* and *Viscaria*. *Caryophyllaceæ*. Interesting flower-garden herbs.

The technical generic characters are so variable as to allow the genus to be thrown into *Silene* or to be broken up into 7 or 8 distinct genera (for the latter, see Williams, Journ. Bot. 31:167; Journ. Linn. Soc. 32:11), according to the point of view of the particular author. They are mostly erect-growing, and the



2220. Capsule and seeds of *Lychnis Githago*. (X $\frac{1}{4}$)



2221. Flower of *Lychnis Githago*.

lvs. are opposite and entire. The caps. usually has but one locule or compartment, and the seeds are borne on a central or axile placenta (Fig. 2220). The styles are usually 5 or rarely 4, in this differing from *Silene* (in which the styles are 3), and the calyx-teeth are commonly 5. In some species, the styles are 3 and the caps. is more than 1-loculed at base, but in these cases the habit of the plant and minor technical characters enable one to refer them to *Lychnis* rather than to *Silene*. The stamens are 10; and the petals 5 and usually with a 2-cleft scale or a pair of teeth at the base of the blade. —As defined above, the genus contains 40–50 species, annuals, biennials, and perennials, of the temperate parts of the northern hemisphere. *Agrostemma* and *Viscaria* might be separated, although the distinctions are not very marked. *Agrostemma* has the 5 stamens opposite the petals and the petals are not appendaged; *Lychnis* would then be distinguished as having the stamens alternate with the petals, and the latter are often or usually appendaged so as to form a crown in the corolla. If *Lychnis* is restricted to those species in which the caps. is 1-celled to the base, then *Viscaria* may be distinguished for certain species that are several-celled at the base (see *Viscaria*). For horticultural purposes these distinctions are not important. *Petrocoptis* is here kept distinct. In the following synopsis of the garden kinds, little attempt is made to follow technical botanical divisions.

Some of the species of *Lychnis* are amongst the best known of old-fashioned flowers, as the mullein pink, Maltese cross and ragged robin. These are essentially flower-garden subjects, and of simple cultural requirements. Others, as *L. alpina*, are better known as border or rockwork plants (see also *Petrocoptis*). All species are easily grown from seeds, the biennials and perennials blooming the second year. The perennials are often propagated by division. All of them apparently thrive in the sun.

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A. *Calyx-lobes long and leafy; petals not crowned.*

1. **Githàgo**, Scop. (*Agrostemma Githàgo*, Linn.). CORN-COCKLE. Figs. 2220, 2221; also 1515. An annual weed in wheat-fields, and difficult to eradicate because the seeds are not readily screened from the wheat in the thrasher or fanning-mill: plant strict, 2–3 ft. tall, white-hairy: lvs. nearly linear: fls. long-peduncled, red-purple and showy, the obovate entire petal-limbs exceeded by the narrow calyx-lobes—these lobes falling when the fr. is ripe. Eu.—Rarely cult. in old gardens.

AA. *Calyx-lobes not prolonged and leafy; petals usually crowned.*

B. *Fls. 1 in. or less across, in dense terminal cymes or umbellate heads. (Forms of No. 14 may be sought here.)*

2. **chalcadónica**, Linn. MALTESE CROSS. JERUSALEM CROSS. SCARLET LIGHTNING. Fig. 2222. Perennial, 2–3 ft. tall, usually loose-hairy, the sts. simple or nearly so: lvs. oblong or cordate-lanceolate, clasping (upper ones often narrow and tapering), short-pointed, hairy: fls. 1 in. long, with narrow upward-enlarging ribbed calyx and spreading obovate-notched limb. June. B.M. 257. Gn.M. 5:17.—Probably Japanese, but long in cult., and one of the best of all old-fashioned fls. The fls. are usually brick-red to scarlet, but there are varieties with rose-colored, flesh-colored and white blossoms; also with double fls. G. 4:391. The arrangement of the petal-limbs suggests the Maltese cross, hence one of the common names. Rarely persists for a time as a weed.

3. **fulgens**, Fisch. (not Hort.). An erect-stemmed perennial, hairy: lvs. ovate to ovate-oblong, roughish, tapering below but scarcely petioled: fls. few, in a rather dense terminal cluster, bright scarlet, each petal divided into 2 broad lobes, on the outer side of which are 2 other and very narrow lobes, the ends of the main lobes slightly toothed; calyx oblong or ovate, 10-ribbed, with erect teeth. Siberia, China, Japan. B. M. 2104. B.R. 478.—Perhaps not in cult. in this country. The plant that passes under this name is probably a form of *L. coronata*. From *L. chalcadonica* it is distinguished by lower stature, much larger fls., and the well-marked side teeth or lobes on the petals.

4. **alpina**, Linn. (*Viscaria alpina*, Don). Glabrous, tufted, a foot or less tall: lvs. mostly at the base, thickish, linear or oblong: fls. pink, with 2-lobed petals (segms. linear), and short broad calyx with red teeth. N. Asia, Eu., and Amer.; arctic and subarctic. B.M. 394. L.B.C. 9:881 (as *L. succica*). *L. laponica*, Hort., is apparently a form of this species; said to be perhaps somewhat dwarfer and deeper in color. G.M. 50:209.—An attractive alpine.

BB. *Fls. mostly larger, borne singly or in loose clusters, or at least the clusters not all terminal.*

c. *Plant white-woolly throughout.*

5. **Coronària**, Desr. (*Agrostemma Coronària*, Linn. *Coronària tomentosa*, A. Br.). MULLEIN PINK.



2222. *Lychnis chalcadonica*. (X $\frac{1}{2}$)

DUSTY MILLER. ROSE CAMPION. Fig. 2223. Biennial or perennial, 1-2½ ft. tall, forking toward the top: lvs. oblong, oblong-oval or oblong-spatulate, the lower ones obtuse or nearly so, tapering to a more or less clasping base: fls. large (1½ in. across), circular in outline, crimson or rose-crimson, borne singly on the ends of the branches; petals with appendages at the throat; calyx with filiform teeth. Eu. and Asia. B.M. 21. J. H. III. 57:571. Gn. W. 26:43. G. 30:401.—A common plant of old gardens, and sometimes escaped. The glowing fls. and white foliage make it a conspicuous plant. A hybrid of this and *L. Flos-Jovis* is figured in G. C. III. 2:101.

2223. *Lychnis Coronaria*.

Jovis, Linn. *Coronaria Flös-Jovis*, A. Br.). FLOWER OF JOVE. Fig. 2224. Perennial, 12-18 in., making a clump: lvs. in a rosette, also cauline, oval-lanceolate, more or less clasping: fls. small (½ in. or less across), bright red or rose, in a rather dense, umbel-like cluster. Eu. B.M. 398.—Hardy perennial, rarely seen in old gardens.

cc. Plant not white-woolly, green.

d. Petals 2-notched or 2-cleft. (Forms of No. 14 may be sought here.)

e. Annuals.

7. *Cæli-rôsa*, Desr. (*Agrostemma Cæli-rôsa*, Linn. *Silene Cæli-rôsa*, Rohrb. *Coronaria Cæli-rôsa*, Fries). ROSE OF HEAVEN. Fig. 2225. A very floriferous annual, 12-18 in., glabrous: lvs. linear, long-acuminate and very sharp-pointed: fls. on slender sts., about an inch across, the petals only slightly notched, rose-red, with a linear bifid scale at the throat; calyx club-shaped. Medit. region. B.M. 295.—A popular garden annual, loving the sun. There is a white-fl. form; also var. *fimbriata*, Hort., with toothed petals; and other forms. For an account of the leading garden forms, see Rehder, M.D.G. 1897, p. 346.

Var. *oculata*, Hort. (*L. oculata*, Backh. *Viscaria oculata*, Lindl.), is a handsome form with purple-cyed fls. B. R. 29:53. B. M. 4075.

EE. Biennials and perennials.

8. *diðica*, Linn. (*L. diurna*, Sibth.). RED

or MORNING CAMPION. Fig. 2226. Coarse, hairy and usually somewhat viscid, 1-2 ft. tall, forking above: lvs. ovate-lanceolate or oblong, the cauline ones broad-based or clasping: fls. normally red (varying to pink and white), in loose, elongating or forking clusters (or at first single on the ends of the branches), opening in the morning, not fragrant, more or less diœcious; calyx oblong, reddish, not exceeding ½ in. length: fr. or caps. large and globose, wide-mouthed, the teeth recurved. Eu. and Asia.—Frequent in old gardens, and also run wild in waste grounds in the eastern states. There are double-fl. forms. G.C. III. 48:105 (double).

9. *alba*, Mill. (*L. vespertina*, Sibth.). WHITE or EVENING CAMPION. Fig. 2227. Very like the last, and perhaps not specifically distinct, but more viscid: lvs. longer: fls. usually white and fragrant and opening at evening; calyx longer and green: caps. ovate to conical, with teeth erect or spreading, not recurved. May, June. Eu.—In old gardens and also escaped. There is a double-fl. form. G. 4:319; 8:511; 30:400. This and the last are easily grown biennials or perennials.

10. *Viscaria*, Linn. GERMAN CATCHFLY. Interesting hardy perennial, 6-20 in. high, glabrous but with viscid patches beneath the fl.-clusters: lvs. long-linear, the lower ones tapering toward the base: fls. not large, red, in opposite short-stalked clusters, which form an interrupted glomerate panicle; calyx ¾ in. long, reddish, usually somewhat swollen above the middle, with short teeth. Eu., N. Asia. G. C. III. 20:122.—Sometimes seen in old gardens, and a useful plant with a tufted habit; a most profuse bloomer in sunny places. Var. *alba*, Hort. Fls. white. G. M. 56:455. G. 30:401. Var. *splendens*, Hort., has rose-pink fls. Var. *elegans*, Hort., has scarlet and white-striped fls. There are double-fl. forms. G. 25:347.

11. *Préslii*, Sekera. Perennial (?), 1-1½ ft., with many root-lvs. which are oval-lanceolate or obovate, acuminate: st.-lvs. oval and obtuse, dark green: fls. about 1 in. diam., purple, in forked panicle clusters; petals 2-notched (?); crown fringed, rose; calyx reddish and much inflated. Bolivia.—Apparently little known horticulturally.

12. *yunnanensis*, Baker. Allied to *L. Flos-cuculi*, but with much the habit of *L. sibirica* (see suppl. list, next page): perennial, many-stemmed, 6 or 7 in. high, the sts. slender and pubescent: lvs. lanceolate or linear-lanceolate, sessile, glaucous-green and pubescent, acute: fls. white, the petals much longer than calyx and usually 2-lobed; filaments longer than calyx, the latter 10-nerved, tubular-campanulate, reddish at margin and the segms. ovate and somewhat glandular. China.—Recently offered.

2225. *Lychnis Cæli-rosa*. (Natural size)2224. *Lychnis Flos-Jovis*.

nd. Petals 4-lobed or parted.

13. *Flös-cûculi*, Linn. (*Agrostemma Flös-cûculi*, Don. *Coronaria Flös-cûculi*, A. Br.). RAGGED ROBIN. CUCKOO FLOWER (note the Latin name). Fig. 2228. Perennial, slender, 1-2 ft. tall, slightly roughened, and glandular above; root-lvs. oblanceolate; st.-lvs. lance-linear to linear and rather small; fls. in a loose, cymose-paniculate cluster, red or pink, the petals cut into 4 linear segms.; calyx short-oblong, 10-ribbed. Eu., N. Asia. G. 26:401 (var. *rosca*).—Common in old gardens and also naturalized in parts of the eastern country. The double form (red or white) is prized for its close-packed fimbriate fls.



2226. *Lychnis dioica*. ($\times \frac{1}{2}$)

An old-time and deserving favorite, blooming profusely and for most of the season. Hardy.

Var. *plenissima*, Hort. (*L. plenissima semperflorans*, Hort.), is an excellent very double form, blooming from spring till autumn, and also forcing well.

DDD. Petals several-toothed or fimbriate or nearly entire, not simply 2-lobed (perhaps exceptions in some of the forms).

14. *coronata*, Thunb. (*L. grandiflora*, Jacq.). Perennial, or often biennial under cult., erect, glabrous, 1-1½ ft.; lvs. oval-elliptic and acute, the cauline ones sessile or nearly so; fls. very large (2 in. or more across), the wide-spreading petals sharply several-toothed or somewhat lacinate, brick-red, salmon, or cinnabar, scattered or in an open panicle. China, Japan. B.M. 223. L.B.C. 15:1433. G.C. III. 28:205 and 42:189 (the same cut). R.H. 1911:12. G.M. 51:141. F.S. 10:979.—Half-hardy or tender perennial, growing 1-1½ ft. high, mostly a spring and summer bloomer. Of this handsome plant there are various forms, and to at least some of them the name *L. fulgens* is frequently applied.

Var. *speciosa*, Bailey (*L. speciosa*, Carr. *L. grandiflora* var. *speciosa*, Voss. *L. japonica speciosa*, Hort.). Usually not so tall, very bushy; lvs. narrower and sharper; fls. very large and redder (usually scarlet), the petals less toothed and indistinctly 2-notched. R.H. 1870-1:530.

Var. *Sieboldii*, Bailey (*L. Sieboldii*, Van Houtte. *L. grandiflora* var. *Sieboldii*, Voss). Fls. large and pure white, with lacerate and obscurely 2-notched petals.



2227. *Lychnis alba*. ($\times \frac{1}{2}$)

pyrenaica, Berger = *Petrocoptis*. — *L. Sartorii*, Hort. Said somewhat to resemble *L. dioica* but has narrower and more lanceolate lvs. and the inflated calyx is more elongated, the fls. being similar color of purple and ½ in. across; about 9-12 in. high. China (?).—*L. sibirica*, Linn. Perennial, from Siberia, apparently not in commerce; caespitose; lvs. linear, somewhat hairy; fls. long-peduncled; calyx campanulate-globose, the lobes very short and obtuse; petals 2-lobed.—*L. striata*, Hort., offered abroad, "deep scarlet with distinct white stripes," is probably not *L. striata*, Rydb., of W. U. S.; the latter is a perennial with exserted white or purplish 2-lobed petals and strongly 10-nerved calyx, growing at an altitude of 5,000-10,000 ft. in Colo., Wyo., Utah. L. H. B.



2228. *Lychnis Flos-cuculi*. ($\times \frac{1}{2}$)

15. *Miqueliâna*, Rohrb. Much like *L. coronata* but well distinguished by petals not eroded, bracts and bractlets short and strict, the infl. spreading, peduncles often about as long as calyx; described as a pretty species forming a spreading bush of olive-green foliage and freely producing salmon-red large fls. in Aug. and Sept. Japan.

16. *Haageana*, Lem. (*L. fulgens* forma *Haageana*, Voss. *L. grandiflora* var. *Haageana*, Hort.). Hybrid of *L. fulgens* and *L. coronata* var. *Sieboldii*, and a good intermediate, the fls. being large, with 2-notched petals and 2 short side teeth or lobes and dentate ends to the large lobes. It is a hardy or half-hardy, more or less hairy perennial, 12 in. or less high, in summer producing large clusters of orange-red, scarlet or crimson fls., which are nearly 2 in. across. Very desirable. I.H. 6:195. G.C. III. 42:243. G. 34:675. F.S. 22:2322.

17. *Sénno*, Sieb. & Zucc. Erect-growing villous perennial, with sessile, ovate or lance-ovate lvs. and 1-3 large fls. at the ends of the branches, deep carmine (or in some forms with striped fls.), the petals deeply cut (half their length) into several divisions which are again toothed at the ends; possibly a form of *L. coronata*. Japan.—Little known in this country.

L. Arkwrightii, Hort. Garden hybrid between *L. chaledonica* and *L. Haageana*. Shades of scarlet.—*L. Lagasce*, Hook. f. = *Petrocoptis*.—*L.*

LYCIUM (Greek, *Lykion*, a name given to a Rhamnus from Lycia, transferred by Linnaeus to this genus). *Solanaceae*. MATRIMONY-VINE. BOX-THORN. Ornamental shrubs grown for their flowers and for the attractive fruits, scarlet in most species.

Deciduous or evergreen, thorny or unarmed: lvs.

alternate, often fasciated, short-petioled, entire, without stipules: fls. axillary, solitary or clustered; calyx campanulate, 3-5-toothed; corolla funnelliform, with usually 5-lobed limb; stamens mostly 5: fr. a berry, with few to many seeds.—About 100 species, distributed through the temperate and subtropical regions of both hemispheres.

The matrimony-vines are shrubs with usually spiny branches, rigid in some species, slender and arching or



2229. *Lycium chinense*. ($\times \frac{1}{3}$)

procumbent in others, with rather small and narrow usually grayish green leaves and dull-colored, whitish, purplish or violet flowers, followed by scarlet, rarely yellow or black berries. Most of the species are tender, but *L. halimifolium*, *L. chinense*, and also *L. turcomanicum* and *L. ruthenicum* are hardy North. *L. pallidum* has proved hardy at the Arnold Arboretum. The two first named are especially attractive in fall, when the long and slender branches are loaded with scarlet or bright red fruits, which contrast well with the green foliage. The leaves remain fresh and unchanged in color until they drop, after severe frost. The species are well adapted for covering walls, fences, arbors and other trellis work, but are, perhaps, most beautiful when the branches are pendent from rocks or from the top of walls. They are also used sometimes for hedges, and for warmer regions, especially, *L. horridum* and *L. afrum* may be recommended. The latter is much used in South Africa for this purpose under the name of "caffir thorn." The box-thorns grow in almost any soil that is not too moist. They should not be planted near flower-beds or similar places, where the suckers are apt to become troublesome. Propagation is accomplished readily by hardwood cuttings or suckers; also by layers and seeds.

A. *Lvs. 1 in. long or longer; fls. 5-lobed.*

n. *Corolla-lobes as long or nearly as long as the tube; fls. purplish.*

halimifolium, Mill. (*L. vulgare*, Dun. *L. flaccidum*, Koch). Shrub, with long and slender, spiny or unarmed branches, recurving or sarmentose, glabrous: lvs. cuneate, narrow, oblong-lanceolate, acute or obtuse, grayish green, $1\frac{1}{2}$ -2 in. long; fls. 1-4, long-pedicelled; corolla $\frac{1}{2}$ in. across, limb about as long as tube; filaments hirsute at the base; fr. oval, orange-red or sometimes yellow, to $\frac{1}{2}$ in. long. May-Sept. China to S. E. Eu. Gn. 31, p. 334; 34, p. 63. B.B. (ed. 2) 3:168. G.W. 15, p. 346. Var. *lanceolatum*, Schneid. (*L. lanceolatum*, Poir.). Lvs. lanceolate; frs. oval. Var. *subglobosum*, Schneid. (*L. subglobosum*, Dunal). Dwarfier: lvs. lanceolate; frs. subglobose.—This species and also the following are often confounded with *L. europaeum* and *L. barbarum*, which are chiefly distinguished by the filaments being glabrous at the base, by the longer tube and by the narrower and smaller lvs. They are not hardy N. and are rare in cult. while *L. halimifolium* and the following are hardy.

chinense, Mill. Fig. 2229. Similar to the former, of more vigorous growth: branches to 12 ft. long; lvs. rhombic-ovate to lanceolate, bright green, $1\frac{1}{2}$ -3 in.: fls. somewhat larger; fr. scarlet or bright orange-red, ovate to oblong, sometimes almost 1 in. long. June-Sept. China. G.F. 4:102. F.E. 28:641.—The larger-

fruited form is sometimes distinguished as var. **ovatum**, Schneid. (*L. rhombifolium*, Dipp. *L. ovatum*, Poir. *L. chinense* var. *macrocarpum*, Hort.). Lvs. rhombic-ovate, to 4 in. long; fr. very obtuse at the apex, large. Var. **inermis**, Schelle, is a spineless form.

nn. *Corolla-lobes much shorter than the tube; fls. pale greenish white.*

pallidum, Miers. Fig. 2230. Much-branched upright shrub, to 4 ft., with spreading, spiny branches: lvs. oblanceolate, obtuse, glaucous, somewhat fleshy, $1-1\frac{1}{4}$ in. long; fls. solitary or in pairs, nodding, on short pedicels; corolla pale greenish yellow or whitish, pinkish at base, $\frac{3}{4}$ in. long; tube about 3 times longer than the broadly ovate obtuse lobes; berries globose, $\frac{1}{4}$ - $\frac{1}{2}$ in. across, scarlet. May, June; fr. in July-Aug. Ariz. and Utah to Mex. B.M. 8440. G.C. 111. 46:232. G.F. 1:341 (adapted in Fig. 2230). M.D.G. 1908:209.—Very floriferous and attractive from the peculiar color of its fls., which are rather large for the genus; the very ornamental frs. do not seem to be produced regularly in cult. Does not produce suckers and does not grow readily from cuttings.

AA. *Lvs. small, $\frac{3}{4}$ in. long or shorter.*

B. *Foliage glabrous or puberulous.*

Richii, Gray. Shrub, with slender spiny branches: lvs. short-petioled, cuneate, obovate, obtuse, glabrous or minutely puberulous when young, about $\frac{1}{2}$ in. long; fls. usually 2-3; calyx as long as pedicels, with elongated teeth; corolla $\frac{1}{2}$ in. long, tube longer than 4-lobed limb; fr. globular, bright red, $\frac{1}{4}$ in. across. May-Sept. S. Calif.

horridum, Thunb. Erect, spiny, much-branched shrub, to 3 ft., glabrous: lvs. sessile, spatulate, glabrous, about $\frac{1}{4}$ in. long; fls. short-pedicelled, small, whitish, with rather slender tube and 3-4-lobed limb. S. Afr.—It is not certain whether the plant in the trade is the true *L. horridum* of Thunberg described above, or *L. afrum*, which is much used in S. Afr. for hedges; the latter is easily distinguished by its large purple fls.

nn. *Foliage glandular-pubescent.*

chilense, Bert. Shrub, with slender, often procumbent and mostly spineless branches: lvs. cuneate at base, oblong, glandular-pubescent on both sides, grayish green, $\frac{1}{3}$ - $\frac{3}{4}$ in. long; fls. usually solitary; pedicels longer than the 5-lobed, whitish pubescent calyx; corolla about $\frac{1}{3}$ in. long, pubescent and yellowish outside, limb 5-lobed, purplish within, about as long as tube; fr. orange-red. July-Oct. Chile.—The grayish color and glandular pubescence gives the foliage a frosted appearance. Intro. 1900 by Franceschi, Santa Barbara, Calif.

L. afrum, Linn. Upright, rigid, spiny: lvs. linear-spatulate, small; fls. solitary, tubular, with short limb, purple, 1 in. long. N. and S. Afr. B.R. 354.—**L. barbarum**, Linn. Spiny or rarely unarmed shrub, similar to *L. halimifolium*; fls. 3-6; tube inside and filaments at base glabrous, limb half as long as tube. N. Afr.—*L.*



2230. *Lycium pallidum*. ($\times \frac{3}{8}$)

californicum, Nutt. Spiny shrub, to 2 ft.: lvs. thickish, spatulate, very small; fls. whitish, small; fr. red, small, subglobose. Calif.—*L. europæum*, Linn. (*L. mediterraneum*, Dunal). Spiny shrub, with spreading branches: lvs. spatulate, thickish; fls. short-pedicelled, with the slender tube much longer than limb. Medit. region.—*L. fuchsioides*, HBK.—*Lochroma fuchsioides*.—*L. ruthenicum*, Murr. Upright, spiny; lvs. linear, small, thick; fls. small, with rather long tube; fr. globular, black. S. Russia, W. Asia.—*L. turcomanicum*, Turcz. Slender, spiny, allied to *L. halimifolium*; lvs. and fls. smaller, tube more slender and longer; fr. globular. Turkestan, N. China.

ALFRED REHDER.

LYCOPERSICUM (*wolf peach*; probably an allusion to its inferiority as compared with the peach or possibly to its supposed poisonous qualities). Sometimes written *Lycopersicon*. *Solanaceæ*. **TOMATO**. Familiar garden fruit or vegetable.

Perhaps nearly a dozen herbs of the western side of S. Amer., two of which are in common cult. for their

plane lvs., the comparative absence of stiffish ascending shoots (in the mature plant), few fls., and larger, "smoother" (i. e., not furrowed) fr., which has numerous locules or cells.—There is every reason for believing that the original tomato had a 2-loculed (2-celled) fr., but the course of a melioration has multiplied the locules; it has also modified the foliage and the stature of the plant.

Var. *cerasiforme*, Hort. (*L. cerasiforme*, Dunal). **CHERRY TOMATO**. Still grown for its little globular frs. (in red and yellow), which are often 2-loculed; plant less large and dense-foliaged, the lvs. smaller, grayer; growth more erect.—Probably a very close approach to the wild plant. Frs. used for pickles and preserves.

Var. *pyriforme*, Hort. (*L. pyriforme*, Dunal). **PEAR and PLUM TOMATO**. Differs from the last only in having pear-shaped or oblong frs.—Probably occurs wild in very nearly the form seen in old gardens.

Var. *validum*, Bailey. **UPRIGHT TOMATO**. Fig. 2233. A remarkable cultural form, of low stiff erect growth, and small, condensed, curled lvs.—Originated as a chance seedling in France about 65 years ago. Looks like a potato plant.



2231. Old-time garden tomato, *Lycopersicon esculentum*.

frs. (which in common speech are elassed with vegetables). Fls. small, yellow, nearly rotate when in full bloom, in short superaxillary racemes; stamens 5, connate about the single style; ovary 2-loculed in the non-ameliorated forms, becoming a fleshy many-seeded berry; foliage irregularly or interruptedly pinnate, rank-smelling; plant pubescent, straggling.—Botanically the genus is very close to *Solanum*, from which it is distinguished by the characteristic pinnately compound lvs., and the longitudinally dehiscent anthers which are prolonged into an empty beak. It is united with *Solanum* by Wettstein in Engler & Prantl's "Natürlichen Pflanzenfamilien." In native conditions, tomatoes are probably perennial, but in domestication they are treated as if annual. Tender to frost. See *Tomato*.

esculentum, Mill. (*Solanum Lycopersicum*, Linn.). **COMMON TOMATO**. Figs. 2231, 2235. Plant spreading, with grayish green, mostly conduplicate ("curled") lvs. and slender, ascending shoots: lvs. pinnate, with small, nearly entire lfts. interposed, the main lfts. notched or even lobed toward the base; fls. in a short raceme of 4-6; fr. medium to small, flattened endwise and furrowed on the sides.—In cult. for more than 300 years. Two hundred years ago red and yellow varieties were known. The great evolution of the tomato did not take place until last century, giving rise to the garden race. The plant sometimes escapes from cult. and runs wild for a time.

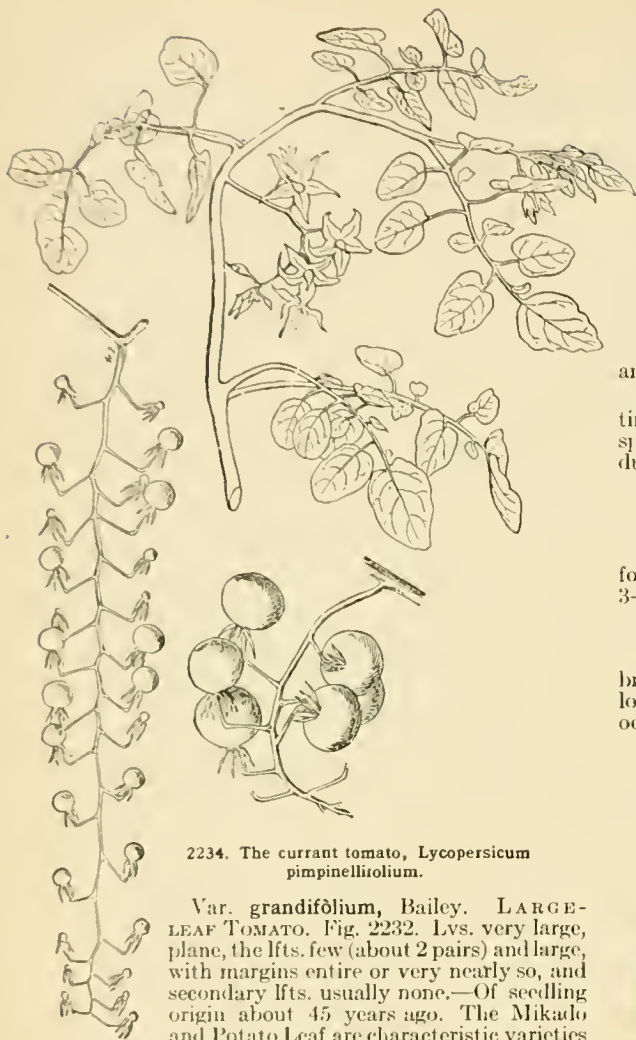
Var. *vulgare*, Bailey. Fig. 2232, No. 2. This is the common garden tomato of N. Amer., distinguished by very heavy growth, greener foliage, much larger and



2232. Leaves of tomatoes: 1, *Lycopersicon esculentum* var. *grandifolium*; 2, var. *vulgare*; 3, cross of the two.



2233. Tree tomato, *Lycopersicon esculentum* var. *validum*.



2234. The currant tomato, *Lycopersicon pimpinellifolium*.

Var. *grandifolium*, Bailey. LARGE-LEAF TOMATO. Fig. 2232. Lvs. very large, plane, the lfts. few (about 2 pairs) and large, with margins entire or very nearly so, and secondary lfts. usually none.—Of seedling origin about 45 years ago. The Mikado and Potato Leaf are characteristic varieties of this. In very young plants, the lvs. are usually entire. This race has produced crosses of commercial value with var. *vulgare*. In Fig. 2232, No. 2 is a lf. of var. *vulgare*, No. 1 is var. *grandifolium*, and No. 3 is a lf. of a hand-made cross between the two.

pimpinellifolium, Dunal (*L. racemigerum* and *L. racemiforme*, Lange. *Solanum racemiflorum*, Vilm., not Dunal). CURRANT TOMATO. Fig. 2234. Plant weaker, very diffuse and twiggy, scarcely pubescent; lvs. with small ovate nearly entire lfts., and very small secondary lfts.; racemes elongating, distichous, bearing 10-40 small currant-like red berries. S. Amer.—Grown as a curiosity and for ornament. The plant makes an excellent summer cover for brush or rubbish piles. The frs. are edible, but are too small for domestic use. However, it has been intro. as a garden vegetable under the name of German Raisin tomato. It hybridizes with *L. esculentum* (see Fig. 2235).

L. H. B.

LYCOPODIUM (Greek, *wolf-foot*). *Lycopodiaceae*. CLUB-MOSS. GROUND-PINE. RUNNING-PINE. A group of pteridophytes, with erect or trailing stems, commonly used for holiday decorations.

Leaves narrow, needle- or scale-like, arranged in 4 to many ranks, and bearing spores in sporangia, located either in the axils of ordinary lvs. or in the axils of modified lvs. clustered in spikes.—About 100 species

are known. The spores of some species form the officinal lycopodium powder. The plants which florists grow as lycopodiums are selaginellas. Horticulturally, the species of *Lycopodium* are valuable mainly as oddities. The hardy species are not always easy to get started, and the tender species need special cult. for good results. See *Selaginella*.

A. Lvs. many-ranked.

B. Sporangia in the axils of unaltered lvs.

Selago, Linn. Sts. erect, 3-9 in. long, dichotomously branched; lvs. ascending, hollow at base, glossy green, not reflexed. Northern hemisphere, usually in high altitudes.

lucidulum, Michx. (Fig. 2236), much like preceding, but usually larger, is more common in lowlands, and has lvs. wide in the middle and erose.

squarrosulum, Forst. Sts. pendulous, 1-2 ft. long, 2-3 times dichotomously branched; lvs. firm, dark green, spreading, $1\frac{1}{2}$ - $\frac{3}{4}$ in. long; sporangia in the axils of reduced lvs., forming a spike. E. Indies.

BB. Sporangia aggregated in terminal spikes.

c. Sts. pendulous; lvs. acute.

Phlegmaria, Linn. Sts. $\frac{1}{2}$ -2 ft. long, dichotomously forked; lvs. $\frac{1}{2}$ - $\frac{3}{4}$ in. long, ovate; spikes copious, lax, 3-6 in. or more long. Tropics of Old World.

cc. Sts. erect, tree form.

cérnum, Linn. Sts. erect, reaching 3-4 ft., copiously branched; lvs. crowded, linear; spikes sessile, $\frac{1}{4}$ - $\frac{3}{4}$ in. long, curved downward. Tropics of both hemispheres, occasionally in our Gulf states.



2235. *Lycopersicon esculentum* beneath; *L. pimpinellifolium* at top; hybrid between.

obscurum, Linn. (*L. dendroideum*, Michx. *L. japonicum*, Thunb.). Fig. 2236. Sts. 6–12 in. high, much-branched, forming a somewhat tree-like growth: lvs. loose, erect; spikes erect, $\frac{1}{2}$ –1½ in. long. Temp. N. Amer. to Japan. G.W. 9, p. 520.—The common ground-pine.

ccc. Sts. (main ones) wide-trailing, with erect branches.

annötinum, Linn. Sts. trailing, often several feet long, with numerous ascending branches 6–8 in. high, which bear sessile, solitary spikes. Arctic and North Temperate Zones of both hemispheres.

clavatum, Linn. Fig. 2236. Main st. trailing to the length of several feet, usually much branched; spikes 1–4 on an elongated peduncle. Arctic and North Temperate regions of both hemispheres.—The common club-moss.

AA. Lvs. 4-ranked, on fan-like branches.

complanatum, Linn. Fig. 2236. Sts. trailing on the surface of the ground; branches spreading out in a horizontal plane: lvs. of the under side of sts. reduced to slender, spreading, cuspidate apices: first and second forks of peduncles approximate. Northern hemisphere.—*L. Chamaecyparissus*, R. Br., is an allied species, with sts. growing underground. L. M. UNDERWOOD.

LYCÔRIS (named probably after a nereid in Greek mythology). *Amaryllidaceæ*. Attractive amaryllis-like bulbous plants from China and Japan.

From *Amaryllis*, the genus is separated by technical characters of the fl., which has few rather than many ovules in a cell, and by black rather than green seeds. Perianth funnel-shaped, somewhat irregular, with a short cylindrical tube enlarged at the top, sometimes with scales in the throat; segms. oblanceolate, clawed; stamens inserted near the throat, the filaments long and declinate; ovary 3-celled; the style filiform, the stigma minute and capitate:

bulb tunicated, short-necked; peduncle solid: lvs. linear or strap-shaped; umbel many-fld., bearing red or yellow blooms.—Species about a half-dozen. At least two species are hardy in New England. Two bloom in summer and two in early autumn. Two have red fls., one has lilac or purple fls., one yellow or orange. Three have the perianth-segms. more or less recurved and fluted or crisped at the margin. In all cases the fls. appear without foliage, being borne on a scape 1–3 ft. long, in umbels of 4–12 fls., each 3–4 in. across. The white filaments and yellow anthers are conspicuous features. The lvs. make their growth, die down, and after a long rest the bulbs send up fl.-stalks alone. These plants are highly esteemed in China and Japan, and bulbs are constantly sent to the western world, but with us they seem to be wayward and uncertain, particularly as to the time of blooming. *L. aurea* reverses the custom of nature. It rests in the wet season and flowers in the dry season. How the bulbs can remain dormant during the early Chinese summer, with the thermometer at 85° in the shade and a yearly rainfall of 100 in., is a mystery. Botanically this genus is placed next to *Hippeastrum*, an American

genus, in which the seeds are numerous in a locule, and usually flat, while in *Lycoris* they are few in a locule and turgid. Horticulturally *Lycoris* is most nearly comparable to *Nerine*, but the seeds of the former are black and of the latter green; in *Nerine* the tube is nearly or quite wanting, stamens inserted at base of segms., filaments thickened at base and 3 shorter, style obscurely tricuspidate, fls., red.

For many years, *L. aurea* has been cultivated in American gardens, although it is not a common plant. More recently, with large importations of *L. radiata*, the interest in the genus has widened. These species have the handsomer flowers, and are preferably cultivated under glass, although the bulbs are probably hardy in warm protected borders; at least they have more than once been frozen in pots at Elizabeth, New Jersey, without apparent harm. In its habitat in China, *L. aurea* rests in the wet season, and the most success in culture has been found in growing it in a warmhouse, taking care to cultivate the foliage and rest the bulbs in warmth and moist earth. The same general directions may be followed for *L. radiata*. As with all bulbs, a vigorous growth of foliage is essential to the future appearance of flowers. *L. squamigera* and *L. sanguinea* are perfectly hardy; their leaves appear in March, mature and disappear. The flowers come in the nature of a surprise in August. The former species has a

columnar scape 2 to 3 feet tall and a cluster of large, amaryllis-like flowers, of a bright rosy purple, rather attractive in the back row of a garden, but not of first rank. *L. sanguinea* has a scape 1½ to 2 feet, with small orange-red flowers, dull and curious rather than striking. The two former species have the beauty of the *nerines*, but the two latter have none of this resemblance. (J. N. Gerard.)

A. Blooming in July and Aug.

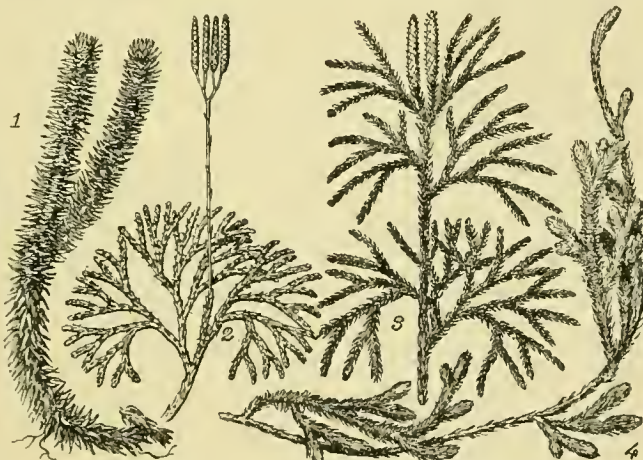
B. Fls. red.

sanguinea, Maxim:

Bulb ovoid, 1 in. diam.; neck 1–2 in. long: lvs. linear. fls. red, 4–6 in an umbel on a peduncle 12–18 in. high; tube ½ in. long; stamens shorter than the perianth-segms. Japan.—The only species with segms. neither wavy or reflexed. Statements that the blooming period is May and June are probably erroneous. A var. *alba* is advertised. It is said that the lvs. of this and the next appear in March; also that the fls. of *L. sanguinea* are dull brownish red.

BB. Fls. rosy lilac.

squamigera, Maxim. (*Amaryllis Hallii*, Hort.). Fig. 2237. Bulb globose: lvs. produced in spring, 9–12 lines wide: fls. rosy lilac, banded yellow; segms. curving, much narrowed below and forming a tube nearly an inch long with truncate scales in the throat (whence the name). Japan. B.M. 7547. G.C. III. 21:137. A.G. 25:119. G.F. 3:177 (reduced in Fig. 2237).—The only fragrant kind. Var. *purpurea*, Hort., intro. about 1898. This species is hardy in New England. It was intro. into this country by Geo. R. Hall, Bristol, R. I. (see p. 1578 for account of Dr. Hall). Apparently the most popular species.



2236. Species of *Lycopodium*: 1, *L. lucidulum*; 2, *L. complanatum*; 3, *L. obscurum*; 4, *L. clavatum*. (After Knobel)

AA. Blooming from Sept. to Nov.

a. Fls. orange-colored.

aurea, Herb. (*Amaryllis aurea*, L'Her. *Nerine aurea*, Bury). GOLDEN SPIDER LILY. Bulb 2 in. diam.; lvs. sword-shaped, 6-9 lines wide, glaucous, produced in May. China. B.M. 409. B.R. 611. G.C. III. 17:263;



2237. *Lycoris squamigera*. ($\times \frac{1}{3}$)

18:545; 47:12, 13. Gn. 47:42.—Baker says it blooms in Aug. and has bright yellow fls., but the colored plates show orange-colored fls.

straminea, Lindl., allied to *L. aurea*, and probably not in commerce: segms. pale straw-color with pink keel and a few scattered red dots: tube very short. China.

BB. Fls. bright red (a white form).

radiata, Herb. (*Amaryllis radiata*, L'Her. *Nerine japonica*, Miq.). Bulb globose, $1\frac{1}{2}$ in. diam.; neck short: lvs. 5-6, produced in winter, linear; stamens much longer than the perianth-segms. China and Japan. B.R. 596. A.G. 13:211.—The perianth-segms. are more recurved than in other species. The tube is very short, while in all the other kinds here described it is $\frac{1}{2}$ in. or more long. Var. *pumila*, Hort., is much dwarfer than the usual forms. Var. *alba*, Hort. Pure white shaded cream. S. Japan.

Recent names in horticultural literature are: *L. incarnata* (Sprenger, Naples). Scape 1-1 $\frac{3}{4}$ ft., bearing 6-12 fls., which are large and widely expanded, pale flesh-colored or bright rose and fragrant; segms. scarcely undulate, not much reflexed. Cent. China. G.W. 10:489.—*L. Sprengeri*, Comes. Fls. rose-pink or purplish rose, on long pedicels, without perianth-tube; spathe-valves short, ovate. Probably Japan. G.C. III. 32:suppl. Dec. 27. G.W. 10:489. Allied to *L. squamigera*, but with shorter less pointed spathe-valves; perianth-tube $\frac{1}{2}$ in. long.

WILHELM MILLER.

L. II. B.†

LYGËUM (Greek, *lygocin*, to bend). *Gramineæ*. Spikelets 1-fl'd., $1\frac{1}{2}$ -2 in. long, with a hard, curved beak, 2-3 together at the summit of the culms, partially inclosed in a foliaceous sheath: sts. slender, wiry, 2-3 ft., from a hard scaly running rootstock: blades involute, flexuous.—Species 1, *L. Spärtum*, Linn., of arid parts of the Medit. region. This species, together with *Stipa*

tenacissima (which see), forms the "Esparto" of commerce, which comes mostly from Spain and Algeria.

A. S. HITCHCOCK.

LYGÏDIUM (Greek, *twining*). *Schizaceæ*. CLIMBING FERNS. A group of ferns with twining vine-like lvs., with the sporangia borne singly under overlapping scales on the under surface of reduced portions of the lf.—Some 30 species are known from all parts of the world. They make an especially attractive growth, and do well when allowed to twine on wires or strings in a large conservatory. For cult. see *Ferns*, p. 1215.

A. Sterile pinnules palmate. (Native hardy species.)

palmatum, Swartz. HARTFORD FERN. Lvs. 2 ft. or more high, twining, bearing pairs of cordate-palmate pinnules $1\frac{1}{2}$ -2 in. long, on short petioles; fertile pinnules 3-4-pinnatifid, with the ultimate divisions linear. Mass. to Fla. and Tenn.—Requires light moist soil and partial shade.

AA. Sterile pinnules pinnate. (Exotic glasshouse species.)

scandens, Swartz. Lvs. many feet long; pinnules 4-8 in. long, 2-4 in. broad, with a terminal segm. and 4 or 5 on each side, which are simple and usually ovate. India and China.—Most of the American material cult. under this name belongs to the next species.

japonicum, Swartz. Fig. 2238. Lvs. many feet long; pinnules 4-8 in. long, nearly as wide, deltoid, with a pinnatifid terminal segm. and 2 or 3 lateral ones on each side, all unequal and the lowest long-stalked and pinnate in the lower part. Japan and the E. Indies.—The common species in cult.

AAA. Sterile pinnules forked.

circinatum, Swartz (*L. dichotomum*, Swartz). Pinnules practically sessile, once forked, the divisions deeply 5-6-lobed, or sometimes forked twice; the sterile segms. 4-12 in. long, $\frac{1}{2}$ - $\frac{3}{4}$ in. broad, the fertile segms. very much contracted. Malaysia.

L. M. UNDERWOOD.

LYONIA (after John Lyon, who introduced many American plants into England; died before 1818, in Asheville, N. C.). Syn., *Xolisma*. *Ericaceæ*. Ornamental shrubs, sometimes grown for their white flowers and dense foliage.



2238. *Lygodium japonicum*. ($\times \frac{1}{3}$)

Deciduous or evergreen; lvs. alternate, short-petioled, entire or serrulate; fls. fascicled or paniced, white; calyx-lobes 4-5, valvate; corolla globular or urceolate, pubescent; stamens 8-10; anthers oblong, truncate at the apex; disk 8-10-lobed; caps. 4-5-valved, with ribs at the sutures and intruded at the apex; seeds numerous, with a loose reticulate testa.—About 10 species in E. N. Amer., W. Indies and Mex. Allied to *Pieris* and often included under *Andromeda*.

The *lyonias* are much-branched shrubs with dull green medium-sized foliage and small white flowers in clusters or panicles. Only the deciduous *L. ligustrina* is hardy North, but is less desirable than other hardy species of allied genera. It prefers moist peaty soil, while the evergreen tender *L. ferruginea* thrives best in a sandy, well-drained soil. Cultivated and propagated like *leucothoë* and *peris*.

ligustrina, Muhl. (*Xolisma ligustrina*, Brit. *Andromeda paniculata*, Ait. *A. ligustrina*, Muhl. *A. parabolica*, Duham. *L. paniculata*, Nutt.). Deciduous, much-branched shrub, to 10 ft.: lvs. obovate to oblong-lanceolate, entire or obscurely serrate, pubescent beneath, 1-2 in. long; fls. in leafless racemes, forming terminal panicles; corolla globose, whitish, $\frac{1}{6}$ in. long. May-July. Canada to Fla., west to Tenn. and Ark. B.B. (ed. 2) 2:691. Var. *foliosiflora*, Fern. Racemes less crowded, often elongated, conspicuously leafy-bracted. Var. *pubescens*, Rehd. (*Andromeda ligustrina* var. *pubescens*, Gray. *A. tomentosa*, Hort., not Dum.-Cours.). A form with soft dense pubescence.

ferruginea, Nutt. (*Xolisma ferruginea*, Heller. *Andromeda ferruginea*, Walt.). Evergreen shrub or small tree: lvs. cuneate, obovate to oblong, with revolute margin, scurfy when unfolding, especially below, 1-2 in. long; fls. nodding, globular, white, in clusters in the axils of the upper lvs. Feb., March. S. C. to Fla. S.S. 5:234. L.B.C. 5:430.—Handsome evergreen shrub, but rarely cult., hardy only S. Var. *arborescens*, Rehd. (*Andromeda rigida*, Pursh). Of vigorous growth, more rigid and with crowded lvs., growing into a small tree. Var. *fruticosa*, Rehd. (*Xolisma fruticosa*, Nash. *A. rhomboidalis*, Nouv. Duh.). Shrubby: lvs. sparser, conspicuously reticulated.

ALFRED REHDER.

LYONOTHAMNUS (*Lyon's shrub*; named for W. S. Lyon, who sent specimens to Asa Gray from Santa Catalina Island, California). *Rasacæ*. Ornamental woody plant grown for its handsome foliage and the large clusters of white flowers.

Evergreen shrub or small tree: lvs. opposite, petioled, lanceolate and nearly entire or pinnate; fls. perfect, in terminal flat corymbs; calyx with 2-3 bractlets at the base; tube hemispherical; lobes 5; petals 5, orbicular; stamens 10, inserted at the margin of the 10-lobed, lanate disk; carpels 2, developing into woody dehiscent caps., each with 4 ovate-oblong seeds.—One species on the islands off the coast of S. Calif. The pinnate-lvd. variety is grown to some extent in N. and S. Calif. and is locally known as "ironwood" or "palo fierro." It is difficult to prop.; seeds are rarely obtainable and only a small percentage germinate; cuttings are usually not successful, but it is said that basal sprouts root more readily.

floribundus, Gray. Usually shrubby: lvs. of the typical form lanceolate, crenulate or subentire, dark green and lustrous above, yellowish green and glabrous or pubescent below, 4-8 in. long and $\frac{1}{2}$ - $\frac{3}{4}$ in. wide; fls. white, $\frac{1}{6}$ - $\frac{1}{4}$ in. across in large corymbs 4-8 in. wide. June, July. Various transitional forms between the foliage of the type and that of the following variety are shown in Zoc. 1:5. Var. *asplenifolius*, Brandegee (*L. asplenifolius*, Greene). Fig. 2239 (after Hall). Sometimes tree-like, to 75 ft.: lvs. pinnately divided into 3-8 incisely lobulate segms. S.S. 4:297.—This variety is quite plentiful on the island of Santa Cruz and also on Santa Rosa and

is cult. for its handsome fern-like foliage; the type, which is found only on the island of Santa Catalina, is less handsome and was never brought under cult.

ALFRED REHDER.

LYSICHITUM (Greek, a loose or free cloak; probably referring to the spathe). Also written *Lysichiton*. *Aracæ*. A genus of one species; a hardy plant resembling the skunk cabbage, which has been offered by dealers in native plants.

Nearly stemless swamp herb with large lvs. from a thick horizontal rootstock: spathe peduncled, sheathing at base, with a broad colored lamina or none, at first enveloping the cylindrical spadix, which becomes long-exserted upon a stout peduncle; fls. perfect, crowding and covering the spadix; perianth 4-lobed; stamens 4; ovary 2-celled, 2-ovuled; ovules horizontal, orthotropous: fr. a 2-seeded berry, immersed in the spadix.

camtschatcense, Schott. Lvs. 1-4 ft. long, 3-15 in. wide, oblong-lanceolate; peduncle shorter than the lvs. May, June. E. Siberia, Japan, Alaska, Ore., Calif. B.M. 7937. G.C. III. 27:219; 57:301. G.M. 48:330.

L. H. B.



2239. *Lyonothamnus floribundus* var. *asplenifolius*.

LYSILÔMA (Greek, probably meaning free border). *Leguminosæ*. About a dozen unarmed trees and shrubs of the American tropics, scarcely cult. They bear bipinnate lvs., and fls. in heads or in cylindrical spikes; petals united into a 5-lobed corolla: pods straight and flat, the valves opening away from the persistent sutures. Some of these plants are often called acacias. *L. acapulcensis*, Benth. (*Acacia acapulcensis*, Kunth). Tree-like: pinnae 8-9 pairs, the lfts. very many, oblong-linear and pubescent, glands 2 or 3 between some of the pinnae: fls. white in cylindrical axillary spikes; stamens many, monadelphous. Mex. Reported in Santa Barbara. —*L. bahamensis*, Benth. (*L. latistilqua*, Gray, not Benth.). WILD TAMARIND. Tree, to 50 ft., wide-spreading: pinnae 3-5 pairs; lfts. 20-50; blades of the latter oblong or oblong-lanceolate, acute, glabrous or nearly so: fl.-heads white, less than $\frac{1}{2}$ in. diam.: pod oblong, flat and undulate. S. Fla., Bahamas, Cuba. —*L. Schiedeana*, Benth. Pinnae 6-9 pairs: lfts. 40 pairs, linear, obtuse, glabrous or minutely puberulent; stipules semi-ovate to falcate: fls. white, in 1-3 axillary pedunculate heads. Mex. —*L. divaricata* (*Mimosa divaricata*, Jacq.) is a doubtful species with synonymy apparently yet to be cleared up.

L. H. B.

LYSIMACHIA (probably after King Lysimachus). *Primulacæ*. LOOSESTRIPE. Erect or creeping leafy herbs grown in damp wild gardens and borders.

Leaves opposite or whorled, entire, usually black-

punctate; fls. spicate, racemose or solitary, with a rotate or campanulate, 5-parted corolla with an equal number of slightly monadelphous stamens opposite the lobes; caps. 1-loculed, with many seeds on a central placenta. —Over 100 species found in temperate and subtropical regions of all parts of the world. Only a few in cult., and these all perennials. They differ from related genera in the absence of staminalia between the stamens, which are usually slightly united. Revision, Knuth in *Das Pflanzenreich*, hft. 22, p. 256 (1905).

The loosestrifes are of easy culture, thriving best in moist situations. Propagation is by division in late autumn or early spring.

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KEY TO THE SPECIES.

- A. Plant shrubby. 1. *Hillebrandii*
 AA. Plant herbaceous.
 B. Color of fls. yellow.
 C. St. creeping; lvs. round-ovate, obtuse. 2. *Nummularia*
 CC. St. erect; lvs. ovate-lanceolate or linear, mostly acute.
 D. Fls. in dense axillary pedunculate clusters. 3. *thyrsiflora*
 DD. Fls. in dense terminal clusters surrounded by large lvs.; cauline lvs. very small. 4. *paridiformis*
 DDD. Fls. racemose or axillary.
 E. Whole plant glabrous or nearly so; fls. 3-6 lines broad.
 F. The fls. in terminal racemes. 5. *terrestris*
 FF. The fls. axillary. 6. *quadrifolia*
 EE. Whole plant densely pubescent; fls. 9-12 lines broad.
 F. Calyx 2 lines long, dark-margined; fls. in leafy panicles. 7. *vulgaris*
 FF. Calyx $3\frac{1}{2}$ -5 lines long, not dark-margined; fls. axillary. 8. *punctata*
 BB. Color of fls. white; pedicels short.
 C. Lvs. opposite, somewhat connate. 9. *Ephemerum*
 CC. Lvs. alternate, attenuate at base.
 D. Blades glaucous beneath, oblong-linear. 10. *barystachys*
 DD. Blades green, lanceolate or ovate-lanceolate.
 E. Plant glabrous; lvs. oblong. 11. *Fortunei*
 EE. Plant puberulent; lvs. ovate. 12. *clethroides*
 BBB. Color of fls. red, blue or purple.
 C. Calyx-lobes acuminate, slightly shorter than the entire-lobed corolla. 13. *Leschenaultii*
 CC. Calyx-lobes obtuse, much shorter than the usually crose-lobed corolla. 14. *nutans*

1. *Hillebrandii*, Hook. Shrub $1\frac{1}{2}$ -8 ft. high, densely branched, often red-tomentose; lvs. alternate, subopposite or verticillate, lanceolate, ovate or linear, acuminate at each end, coriaceous, short-petioled; calyx-lobes acuminate; corolla reddish purple, campanulate; lobes obovate, obtuse; stamens included. Hawaiian Isls.

2. *Nummularia*, Linn. MONEYWORT. CREEPING CHARLIE. CREEPING JENNY. Glabrous, forming large patches; lvs. opposite, rarely cordate, petiolate, $\frac{1}{2}$ -1 in. long; fls. 8-12 lines broad; sepals cordate or lanceolate, acute, half as long as the 5 oval, sparingly dark-dotted corolla-lobes; filaments glandular. June-Aug. Eu.; also naturalized extensively in the E. U. S. R.H. 1891, p. 303; 1899, p. 21. B.B. 2:589.—Very useful for rustie

vases and baskets, also for carpeting ground in shady places. Sometimes a low weed in lawns. Var. *aurea*, Hort. Lvs. all or in part bright yellow.

3. *thyrsiflora*, Linn. (*Naumburgia guttata*, Moench). Glabrous; st. simple, 1-3 ft. high; lvs. opposite, lanceolate; fls. small, 2-3 lines long, yellow, in short pedunculate axillary heads; calyx-lobes narrow; corolla-lobes linear, dotted. Swamps, N. E. N. Amer. and Eu. B.M. 2012.—Prefers shallow water.

4. *paridiformis*, Franch. Glabrous; st. verticillately branched above; upper lvs. large, 3-5 in. long, whorled, sessile, elliptic or obovate-lanceolate, acuminate, glaucous beneath; lower very small, opposite; fls. large, yellow, condensed into a dense cluster surrounded by large lvs., sometimes also axillary clusters; sepals lance-subulate; corolla campanulate; lobes lanceolate, acute; stamens included. China. B.M. 7226.

5. *terrestris*, BSP. (*L. stricta*, Soland.). Simple or branched, glabrous, 8 in. to 2 ft. high; lvs. opposite, lance-linear, acute at both ends, glaucous beneath, scarcely veiny, 1-3 in. long; fls. 3-5 lines broad, very numerous, in a distinct, elongated, terminal raceme; pedicels 3-9 lines long, slender; corolla yellow, the lobes elliptical, streaked with dark lines; filaments glandular. Common on moist ground in the E. U. S. B.M. 104 (as *L. bulbifera*). B.B. 2:588. Blanchan Nat. Gard., p. 324.—Often bears bulblets in the lf.-axils after flowering.

6. *quadrifolia*, Linn. Usually simple, sometimes slightly pubescent, 1-3 ft. high; lvs. verticillate, in 3's-4's, rarely some opposite, lanceolate, oblong or ovate, acute, 1-4 in. long, green beneath, veiny; fls. axillary, 3-6 lines broad, on very slender pedicels, which are $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long; calyx and corolla as in *L. terrestris*. Dry soil. E.U.S. B.B. 2:588.

7. *vulgaris*, Linn. COMMON YELLOW LOOSESTRIFE. Tall and erect, 2-3 ft. high, and stout; branched above, downy, especially on the st.: lvs. verticillate, in 3's-4's, ovate-lanceolate or lance-oval, acute at both ends, nearly sessile; fls. in the upper axils, or densely paniculate at the summit; calyx often dark-margined; corolla large, the lobes broad, glabrous. Eu., Asia. R.H. 1891, p. 303.; 1899, p. 21.—Very showy when grown in clumps.

8. *punctata*, Linn. (*L. verticillata*, Bieb.). Tall and stout; lvs. verticillate, in 4's, lanceolate, ovate or cordate-ovate, acute, subsessile; corolla-lobes oval, denticulate, glandular-ciliate, acute; stamens united. Very similar to *L. vulgaris*, but differs in the larger calyx-lobes not dark-margined; fls. in axillary, equidistant whorls, not paniculate, and corolla glandular. Eu., W. Asia. B.M. 2295 (as *L. verticillaris*). G.M. 57:111.

9. *Ephemerum*, Linn. Smooth: lvs. opposite, glaucous, elongate-lanceolate, obtuse, connate and somewhat decurrent; raceme long, terminal; bracts equaling the short (2-4 lines long) pedicels; fls. white, often tinged with purple; calyx-lobes ovate, obtuse; corolla-lobes ovate, obtuse, twice as long as the calyx; stamens slightly exserted. S. Eu. B.M. 2346. R.H. 1891, p. 303.

10. *barystachys*, Bunge (*L. brachystachys*, Hort.). St. strict, simple, hispid and leafy above; lvs. few, alternate, linear-oblong, abruptly acute, attenuate at base, appressed puberulent, glaucous beneath; raceme at first nodding, dense, terminal, spike-like; bracts exceeding the short pedicels; fls. white; calyx shorter than the corolla; the lobes ovate, obtuse, ciliate, membranous-margined; corolla-lobes oblong-linear, obtuse, longer than the stamens. China. R.H. 1881:90.

11. *Fortunei*, Maxim. Glabrous; lvs. alternate, oblong-lanceolate, acuminate or mucronate; base acuminate, cartilaginous-margined; raceme dense; bracts equaling the short (1-2 lines long) pedicels; fls. white; calyx broadly campanulate; the lobes obtuse, mem-

branous-margined; corolla longer; the lobes ovate, obtuse. China, Japan.

12. *clethroides*, Duby. Tall and stout, 3 ft. high or less, sparingly pubescent, rarely glabrous: lvs. opposite, large, 3-6 in. long, and sessile, broadly lanceolate, attenuate at each end, radical spatulate; fls. $\frac{1}{2}$ in. diam., in a very long, slender, terminal spike; pedicels short, bracts subulate; fls. white; calyx blackish, shorter than corolla; lobes lanceolate, acute, membranous-margined; corolla-lobes ovate-lanceolate, obtuse; stamens included. China, Japan. Mn. 8, p. 141.—Fine for cut-flowers, also for border.

13. *Leschenaultii*, Duby. Somewhat branched: lvs. opposite or verticillate in 3's, lanceolate, acuminate, glabrous, short-petioled: raceme dense, terminal: bracts shorter than the pedicels: fls. blue or purple; calyx much shorter than corolla; lobes narrow, acuminate; corolla campanulate; lobes obovate, obtuse, entire; stamens unequal, exserted. Mountains of India. R.H. 1891, p. 303.

14. *nütans*, Nees. St. subsimple: lvs. opposite or verticillate in 3's, lanceolate, acuminate, very smooth, attenuate at base: racemes dense, terminal; pedicels very short at first; fls. deep bright reddish purple; calyx one-third as long as corolla; lobes lance-linear, obtuse; corolla tubular-campanulate; lobes lance-spatulate, obtuse, erose-denticulate; stamens exserted. Marshy regions, S. Afr. B.M. 4941. G.Z. 2:16.

L. ciliata, Linn.=*Steironema ciliatum*.—*L. hybrida*, Michx.=*Steironema lanceolatum*. R.H. 1846:21.—*L. lanceolata*, Walt.=*Steironema lanceolatum*.

K. M. WIEGAND.

LYSIONÔTUS (name refers to the opening of the caps. at the back). *Gesneriaceæ*. Six to 10 small shrubs, India to China and Japan, grown sometimes under glass for the blue or white fls., but apparently not in the trade. Some or all are epiphytic; glabrous: lvs. opposite or in 3's: fls. in few- to many-fl'd. inconspicuously bracted cymes; sepals narrow; corolla tubular and straight, inflated at middle, 2-lipped; stamens 2 perfect and 2 or 3 staminodia; the filaments flattened; disk ring-like: caps. very narrow, 2-valved. *L. serrata*, Don (*L. ternifolia*, Wall.), is about 1 ft. high: lvs. elliptic or lanceolate, serrate or sinuate: fls. pale lavender or white and purple-veined, an inch or two long, about 10 or less in peduncled clusters. Subtrop. Himalayan region, 2,000-7,000 ft. B.M. 6538. *L. carnosa*, Hemsl. Dwarf shrub with straight rigid branches: lvs. in 3's, short-stalked, thick and fleshy, ovate, few-toothed: fls. $1\frac{1}{2}$ in. long, white tinged lilac, in pairs in the upper axils. China. *L. warleyensis*, Hort. Little shrub, 9 in. high: lvs. opposite or in 3's, oblong to lanceolate, few-toothed, fleshy, white beneath, the petiole crimson: fls. white with 3 purple lines, 2 in. long. China.—A beautiful plant, of very recent intro. *L. carnosa*, Hemsl., is a dwarf shrub from China, glabrous, with straight and rigid green branches: lvs. in 3's, short-stalked, fleshy, ovate, to 2 in. long, dentate: fls. $1\frac{1}{4}$ in. long, white tinged lilac, in pairs in the upper axils.

L. H. B.

LYTHRUM (Greek, *blood*; possibly from the styptic properties of some species, or the color of the flowers). *Lythraceæ*. Herbs or subshrubs, of which three are cultivated in hardy borders.

Branches 4-angled: lvs. opposite, or alternate, rarely whorled, linear-oblong or lanceolate, entire; fls. rosy purple or white, in the upper axils usually solitary, lower down more or less whorled; calyx-tube cylindrical, 8-12-ribbed; petals 4-6, obovate; stamens as many or twice as many; caps. 2-celled, with an indefinite number of seeds.—Koehe in his monograph of the *Lythraceæ* recognizes 24 species, widely scattered.

Lythrums grow about 2 to 3 feet high in the wild, but improve markedly in cultivation, often attaining 4 to 5 feet and flowering freely. Some of them are called willow-herbs from their strong, erect habit and willow-like leaves. They are of easy culture in any moist soil, and are usually planted amid shrubbery, where they hold their own. They are denizens of low grounds, swamps and meadows, often growing in the water. They flower in summer and are propagated by division. (F. W. Barclay.)

A. *Stamens twice as many as the petals.*

B. *Fls. in an interrupted, leafy spike.*

Salicaria, Linn. (*L. anceps*, Hort.). SPIKED or PURPLE LOOSESTRIFE. BLACK BLOOD. Fig. 2240. Height 2-3 ft.: lvs. opposite or sometimes in whorls of 3, lanceolate, 2-3 in. long; fls. purple; stamens barely if at all exserted. North temperate regions. Austral. B.B. 2:473. G. 3:622.—

Best of the genus. Koehe has made 29 botanical varieties and subvarieties of this one species. Var. *superbum* and var. *roseum*, Hort., have rose-colored fls. Var. *roseum superbum*, Hort., may be the same as the preceding varieties. It is large-fl'd., rose-colored, more robust (4-6 ft.); somewhat later in blooming. July-Sept.; a clearer, finer colored form than the species. It is generally sold as *L. roseum superbum* (not as a variety of *L. Salicaria*). G. 29:167. Var. *atropurpureum*, Hort., is a fine variety producing large spikes of very dark rose-purple fls. Var. *tomentosum*, DC. Lvs. tomentose. Var. *roseum*, Perry's Variety, has cherry-red fls., larger and upon longer spikes. Excellent for the bog-garden.

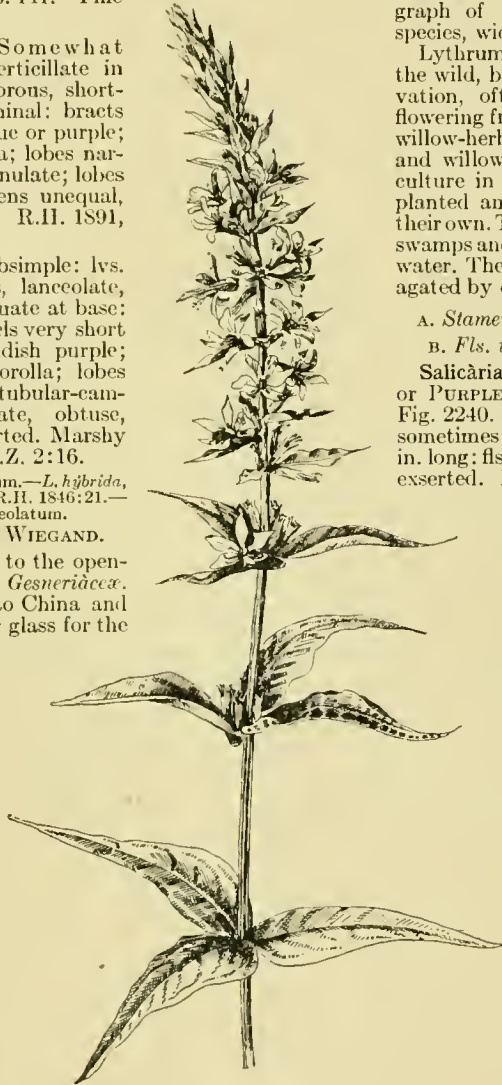
BB. *Fls. solitary in the upper axils, racemose.*

virgatum, Linn. (*L. austracum*, Jacq.). Lower lvs. opposite, rounded at the base: calyx not bracted: fls. smaller than *L. Salicaria* and rose-purple. Eu., N. Asia.—Of good landscape value and compact growth: the brightest colored kind of lythrum. Var. "Rose Queen" is much cataloged.

AA. *Stamens not more numerous than the petals.*

alatum, Pursh. Two ft. tall: half shrubby, with twiggy 4-angled branches: lvs. mostly alternate, obtuse: stamens exserted: fls. crimson-purple. June to Sept. N. Amer.

WILHELM MILLER.
A. C. HOTTES.†



2240. *Lythrum Salicaria*. ($\times \frac{1}{2}$)

M

MAACKIA (after Richard Maack, Russian naturalist who explored northeastern Asia; 1825-1886). *Leguminosae*. Trees grown out-of-doors for their handsome foliage and the panicles of white flowers.

Deciduous: winter-buds free, scaly; lvs. alternate, odd-pinnate, with entire, opposite or nearly opposite short-stalked lfts.: fls. white, papilionaceous, in dense upright racemes, usually several in terminal panicles; calyx campanulate, 5-toothed; stamens 10, more or less connate: pod linear-oblong, compressed, with 1-5 seeds. —Two or three species in E. Asia; usually united with *Cladrastis*, but easily distinguished even without fls. by the free scaly winter-buds and the opposite lfts.; in *Cladrastis* the winter-buds are naked and inclosed in the base of the petiole and the lfts. are alternate.

The maackias are small or medium-sized trees or rarely shrubs with rather large pinnate foliage and upright dense panicles of small white flowers appearing in summer. They are hardy North and not particular as to the soil, but prefer a warm and sunny position to bloom well. Propagation is by seeds sown in spring or by root-cuttings like *cladrastis*.

amurensis, Rupr. (*Cladrastis amurensis*, Koch). Tree, to 40 feet.: lfts. 7-11, elliptic- or oblong-ovate, rounded at the base, glabrous, 2-3 in. long; racemes erect, dense-fl., usually panicle, 4-8 in. long; fls. whitish, about $\frac{1}{2}$ in. long; pod $1\frac{1}{2}$ -2 in. long. July, Aug. Manchuria. B.M. 6551. Gn. 24, p. 265; 33, p. 441; 44, p. 60. F.S.R. 3, p. 23. G. 6:379. H.F.H. 13:298. Var. *Buèrgeri*, Schneid. (*Cladrastis amurensis* var. *floribunda*, Shirasawa), from Japan, has the lvs. pubescent beneath. S.I.F. 1:50.

M. Tashiroi, Makino (*Cladrastis Tashiroi*, Yatabe). Shrub: lfts. 9-15, nearly glabrous, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. long; fls. smaller; standard not emarginate. Japan. Tokyo Bot. Mag. 6:10.

ALFRED REHDER.

MABA (native name). *Ebenaceae*. Some 60-70 species of trees and shrubs in the warmer regions of the world, mostly with hard chony-like wood. Closely allied to *Diospyros*, the floral parts mostly in 3's instead of 4's or 5's, stamens usually 9 but varying from 3 to many, ovary 3- or 6-celled; lvs. usually smaller than in *Diospyros*. Lvs. alternate, simple and entire; fls. axillary, solitary or in short cymes, usually dioecious;

corolla bell-shaped or tubular; styles 3, or 1 and 3-parted: fr. a berry, ovate or globose, 1-6-seeded. Two species have been intro. S. as ornamental subjects.

natalensis, Harv. Much-branched evergreen shrub, with flexuous branches: lvs. wide, ovate, oblong or elliptical, obtuse, dark green above, paler beneath, glabrous, netted-veined beneath; female fls. solitary; calyx cup-shaped, glabrous, entire; abortive stamens 6-7; ovary glabrous; berries in large bunches, black. Natal; offered in S. Fla.

sandwicensis, A. DC. Attractive tree, 20-40 ft.:

lvs. thick and leathery, dull green, elliptic or ovate-oblong, distichous: fls. single or the males rarely clustered, small, the corolla 3-toothed and densely hairy on upper half; male fls. with

12-18 free stamens: fr. dry or somewhat fleshy, usually 1-seeded at maturity, bright reddish yellow. Hawaii (where it is known as "lama") and Fiji; offered in S. Calif. L. H. B.

MABÈA (from *piriri-mabe*, the name in Guiana). *Euphorbiaceae*. Climbing or creeping shrubs, some with economic uses, if not in cult. Juice milky: lvs. alternate, simple, pinnately veined, short-petioled, pubescent: fls.

monœcious, apetalous; staminate calyx 3-5-lobed, lobes imbricate; stamens 10-70; styles connate into a long, slender column, free above; ovary 3-celled, 1 ovule in each cell; seeds carunculate. —Thirty species in Trop. S. Amer. Related to *Sapium* and *Stillingia*. *M. fistulosa*, Mart., is used in Brazil for pipe-stems and in medicine. This species and *M. occidentalis*, Benth. (*M. Piriri*, Benth.), yield some rubber. J. B. S. NORTON.

MACADAMIA (after John Macadam, M.D., secretary Philosophical Institute, Victoria, Australia). *Proteaceae*. A small group of Australian trees or tall shrubs, of which *M. ternifolia* is cultivated for its edible fruit, and is the best known.

Leaves verticillate, entire or serrate; fls. hermaphrodite, pedicellate in pairs or scattered, in terminal or axillary racemes or panicles; perianth regular or nearly so; stamens inserted a little below the blades, filaments short; ovary sessile, with a long straight style, ovoid or



2241. *Macadamia ternifolia*; a, nut showing dehiscence of husk; b, cross-section; c, longitudinal section. (Spray $\times \frac{1}{2}$, separate leaf $\times \frac{1}{4}$, nuts $\times 1$)

clavate at end, stigma small; ovules 2; fr. globular; seeds either solitary and globular or 2 and hemispherical; testa membranous.

ternifolia, F. Muell. QUEENSLAND NUT. Fig. 2241. In its typical form this is a tall tree, with dense foliage, the young branches and infl. minutely pubescent; lvs. sessile or nearly so, glabrous and shining, in whorls of 3 or 4, oblong or lanceolate, acute or obtuse, serrate or entire, from a few inches to 1 ft. long; racemes almost as long as the lvs.; perianth minutely pubescent or glabrous; ovary villous, style end clavate; fr. with a 2-valved leathery exocarp, endocarp smooth and shining, thick and very hard; seeds 1 and globular or 2 and hemispherical. Queensland and New S. Wales. G.C. 1870: 1181.—Other species are *M. Whelanii*, Bailey, Queensland, a medium-sized tree; *M. preclita*, Bailey, Queensland, sometimes lofty, wood of reddish color, useful for cabinet-work, as is that of nearly all species; *M. Lévii*, Bailey, Queensland, the Maroochic nut, tree 15–20 ft. high, forming 6–20 woody sts. from a hard, spreading rhizome, and with a pointed, ribbed fr. about 1 in. diam., edible; *M. minor*, Bailey, Queensland, the small-fruited Queensland nut, small tree or large shrub, sending up numerous sts. from base, lvs. up to 2 in. long, fr. up to 1 in. diam., velvety outside, sometimes inversely conical in form, edible.—The Queensland nut is cult. to a small extent in S. Calif. and S. Fla., and has recently fruited in Cuba, where it appears to thrive. It is slow in growth, rarely coming into bearing before 6–8 years of age, and delights in a deep rich loamy soil, containing plenty of moisture. It has succeeded in Calif., however, with very little water, though its growth under such conditions is naturally slower. Several distinct forms of the tree are thought to exist, but the typical one is upright, sometimes 50 ft. in height, with a clean trunk and a deep green umbrageous head of foliage. The nuts are about 1 in. diam., with a hard shell about $\frac{1}{8}$ in. thick, which is rather difficult to crack. The kernel is $\frac{1}{2}$ in. or more in diam., white, crisp, and of a flavor resembling that of the Brazil nut (*Bertholletia excelsa*) but milder and more delicate. The tree is evergreen, and even while young withstands slight frosts (perhaps 26° F.) uninjured. For its ornamental appearance alone it is worthy of a place in parks and gardens. Its close-grained reddish timber is considered of value for cabinet-making. Prop. is usually by seeds, which may be stratified in sand or planted singly in pots of light, porous, sandy soil. If planted during the summer or if artificial heat is provided they will usually germinate within a month or 6 weeks; otherwise they may take a long time. When the seedlings make their appearance water should be given sparingly, as they are likely to damp-off if kept too wet. Plants may be set out in the open ground when about 18 in. high, and should be staked to keep them shapely. Practically no pruning is required. A promising tree for intro. into the American tropics and the warmest parts of the U. S.

F. W. POPENOE.

MACARÁNGA (the Madagascar name). *Euphorbiaceae*. Trees or shrubs, rarely cult. in greenhouses or in tropical lands. Lvs. alternate, simple, entire, palmately nerved, peltate; fls. dioecious or monoecious, inconspicuous, apetalous; calyx valvate; anthers 3–4-celled; styles free, short, undivided; ovary 1–3-celled, 1 ovule in each cell. Species more than 100 in the Old World tropics. Related to *Mallotus* and *Mercurialis*. Prop. and cult. similar to codium. *M. Porteana*, André (*Mappa Porteana*, Hort.), of Philippine Isls. A very striking plant, with orbicular-ovate, strongly ribbed lvs. nearly 3 ft. wide, and small fls. in red panicles, is in cult. in Eu. R.H. 1888, p. 176. G.C. III. 16:284. B.M. 7407. *M. kilimandscháríca*, Pax, resembles *M. Porteana* in habit, but is smaller, with peltate lvs., bronze-colored when young. Gerinan E. Afr. The other species appear not to be in cult.

J. B. S. NORTON.

MACFADYÈNA (Dr. J. Macfadyen, author of a flora of Jamaica). *Bignoniaceae*. As defined by Benth & Hooker, 21 species of tall-climbing shrubs in Trop. Amer. and extra-Trop. S. Amer., including *Dolichandra*; as defined by Schumann in Engler & Prantl, 3 species in S. Amer., excluding *Dolichandra* and others. The plant in the trade (offered in S. Calif.) is *M. cynanchoides*, Morong (or *Dolichandra cynanchoides*, Cham.). It is a glabrous liana of S. Brazil and Argentina: branches slender and terete; lvs. opposite, of 2 oblong, ovate or ovate-lanceolate acute entire lfts. and usually a 3-parted tendril at end; fls. single or few on the peduncle, red; calyx cut to the middle, spathaceous; corolla long, tubular ($2\frac{1}{4}$ in. long); stamens 5, one being a rudiment, exserted; stigma exserted: fr. a caps. 3 in. long and $\frac{3}{4}$ in. wide.

M. dentata, Schum. (*Bignonia Fraseri*, Hort. B. Tweediana, Griseb., not Lindl. M. Tweediana, Griseb.). A strong climber, self-clinging, with 3-forked tendrils: lfts. 2, ovate to ovate-oblong, short-acuminate, dentate, lepidote on both sides, glossy above, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long; fls. axillary, solitary; calyx split; corolla tubular-funneliform, yellow, $2\frac{1}{2}$ in. long, outside lepidote; ovary lepidote: caps. linear, 7–12 in. long. Brazil to Argentina. Intro. in S. Calif.

L. H. B

MACHÆRIUM TIPU: *Tipuana speciosa*.

MACHINERY AND IMPLEMENTS. The American farmer is known by his tools and machinery. Labor costs much and land relatively little. The American is inventive. The result is that there is a tool to expedite and lighten almost every labor. The effort of each man is multiplied. Not only are the American tools numerous and adapted to almost every agricultural labor, but they are trim, light and comely in design.

A tool is properly a hand implement, used to facilitate mere manual labor. A machine is a contrivance, usually more elaborate, that multiplies and transmits power or motion. Yet tools and machines merge so completely that it is impossible to make a definite category of one or the other. The word implement is more generic, and applies to any intermediary device by means of which a man accomplishes a given work. The phrase "agricultural implements," as used by tradesmen, usually refers to both tools and machines. In general discussions the word tool is used somewhat indefinitely, as in this sketch; but even then it does not include complicated machinery.

The machines and tools used by horticulturists may be thrown into five general categories:

1. To till the land, as plows, harrows, rollers, cultivators, weeders, hoes, rakes. See *Tillage*.
2. To facilitate various handwork, as seed-sowers, transplanters, markers, pruning implements, and most greenhouse devices.
3. To facilitate the destruction of insects and fungi, as fumigators, syringes, spraying devices. See *Diseases and Insects*, Vol. II.
4. To transport, as carts, barrows.
5. To aid in packing and sorting. See article on *Packing*.

In the multiplicity of tools, one is often at a loss what to purchase. The buyer should have a definite idea of the kind of labor that he needs to have performed and he should then consider how well adapted the tool may be to perform it. Once purchased, the tools should be cared for. A tool-shed or -room is the greatest convenience and often good economy. Labor is expedited and annoyance saved if each tool has its place. Every farm or garden should be provided with a room that can be warmed in cold weather, in which repairs can be made on machinery and implements. No farm establishment is complete without such a room. The care of tools not only contributes to the longevity and usefulness of the implements themselves, but it sets distinct ideals before the farmer and thereby is a means of educating him. The greater the variety and the better the quality of the tools the more alert the user of them

is likely to be. One should look up the new ideas in tools each year as one does in markets or crops. The advertising pages of rural journals are suggestive in this direction.



Hoeing the ground.



Plow drawn by men.



Plow drawn by oxen.

2242. Tools in the sculptures on a Theban tomb.

The very early tool for opening or tilling the ground appears to have been a forked or crotched stick, one prong of which was used as a handle and the other as a cleaving instrument. From this the hoe and the plow appear to have developed. (Fig. 2242.) This set of illustrations shows sculptures from a Theban tomb "of the eighteenth or the beginning of the nineteenth dynasty;" it is reproduced from Daubeny's "Lectures on Roman Husbandry," in which it is said that "The plough itself is nothing more than a modification of the hoe, which was first dragged along the ground by manual labor, before the force of oxen was substituted."

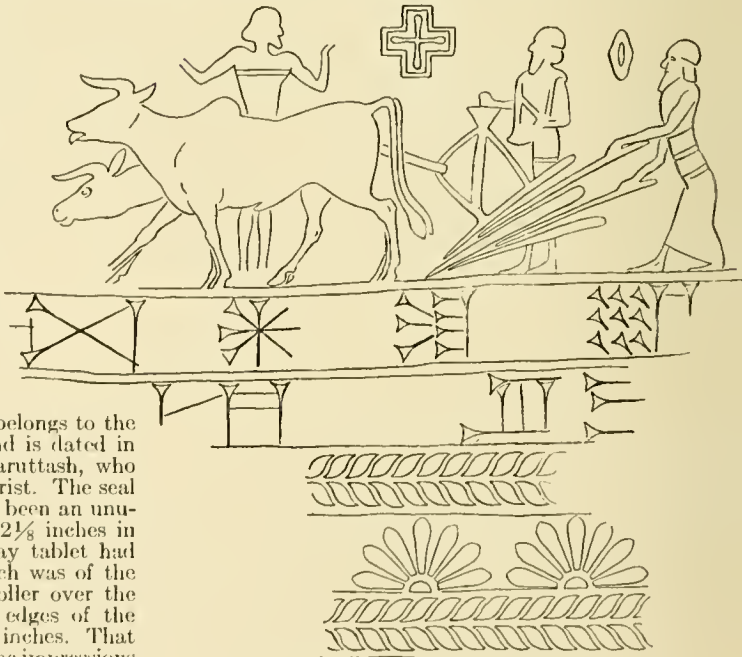
In "The Museum Journal," published by The University Museum of Philadelphia, June, 1910, Babylonian Section, is an interesting account by A. T. C., of "an ancient plow," together with an illustration (Fig. 2243). "An exceedingly interesting seal impression depicting a plow, drawn by two oxen, is found on a clay tablet with a cuneiform inscription in the University Museum. This tablet belongs to the Cassite period of Babylonian history, and is dated in the fourth year of the reign of Nazi-Maruttash, who lived in the fourteenth century before Christ. The seal used to make the impression must have been an unusually large one, for it measured about $2\frac{1}{2}$ inches in length. After the surface of the soft clay tablet had been covered with writing this seal, which was of the usual cylindrical form, was run like a roller over the inscription on both sides and the four edges of the tablet, which measure about $2\frac{3}{4}$ by $4\frac{1}{2}$ inches. That is, the entire document was covered with the impressions of different parts of this large seal. Unfortunately, there is no complete impression of the seal on the tablet.

Some of the parts were repeated a number of times, but other parts seem to be entirely wanting. Moreover, the surface of a portion of the tablet has suffered considerably, due probably to the moisture in the earth, or exposure to the atmosphere after the tablet had been excavated. The accompanying drawing of the seal impression (Fig. 2243) was made after a careful study of the different traces found on the various parts of the tablet by Herman Faber, Miss Baker and the writer.

"The plow gang consists of three men. The one depicted larger in size than the others is doubtless the chief. He appears to be driving the animals, as is indicated by his raised arm, perhaps holding a whip. Another, having a bag over his shoulder, is in the act of feeding the tube or grain-drill, through which the seed was dropped into the furrow made by the plow, which is being guided by the third man. The animals drawing the plow, known as *alpu*, 'ox,' in the inscription, are in use in Babylonia at the present time. It is the Zebu or humped bull (*Bos indicus*).

"The individual for whom the seal was cut regarded himself as a devotee of Nin-Sar, the god of vegetation, as the first line of the inscription shows (ARAD-NIN-SAR). Unfortunately the name of the owner in the second line is so imperfectly preserved that it cannot be read.

"For some time other representations of the plow in antiquity have been known, but in no instance is it so accurately represented as in this seal impression. A boundary stone of Meli-Shipak, of the Cassite period, recently found at Susa, contains the picture of a plow, which has hitherto been regarded as the earliest. It does not seem to have a tube. There is another picture of a plow found on an undated fragment belonging to the same period. Later representations of plows with tubes are found on monuments of Sennacherib and Esarhaddon. Plows similar to the one found in this seal impression are in use in Syria at the present time. The plow on the Museum tablet, here discussed, is the earliest known, being about a century earlier than the one on the boundary stone belonging to the reign of Meli-Shipak.



2243. Men plowing and sowing. From a Babylonian seal impression, 14th century B. C.

"It is also interesting to note that one of the latest inventions of our Western civilization whereby the grain is sown by machinery was already anticipated by ancient Babylonians at least thirty-three centuries ago. In fact the simple Babylonian device accomplished what no single piece of modern machinery does, in that it combined the processes of plowing and sowing."

A set of ancient plows is shown in Fig. 2244, reproduced from Bradley's "Survey of the Ancient Husbandry and Gardening," 1725. Bradley's explanation is as follows:

"No. 1. Figure of an ancient Plough, supposed to be used about the Time of the Romans.

"No. 2. Figure of a Spanish Plough, which some suppose, preserves somewhat of the Manner of the Roman Plough, only alter'd to be drawn by one Horse, instead of a Yoke of Oxen. 'Tis said, that the Husbandmen in Spain, will plough two or three Acres of light Land in a Day with this Plough.

"No. 3. The common Shoulder Plough or best Plough, used in several Parts of England, for cutting or breaking the Surface of Grass Grounds, or Heath Lands; 'tis push'd along by one Man; sometimes cutting the Turf half an Inch thick, sometimes an Inch or two. At A is an Iron turn'd up with a sharp Edge, to cut the Turf from the rest of the green Sward.

"No. 4. Is a Figure of the common Dray Plough, which is good to be used for miery Clays in Winter; but is not so proper to be used in Clays when they are hard.

"No. 5. The Figure of a single Wheel'd Plough, used in Sussex.

"No. 6. The Figure of the Hertfordshire Wheel Plough, which is of the easiest Draught; proper for any Grounds, except miery Clays, which are apt to clogg the Wheels. The several Parts of this Plough, being understood, will explain to us the Use of the other Ploughs. A is the plough Beam, B the Handle, Tail, Stilts, or Staves, C the Neck, or Share Beam, D the Earth Board, Mould Board, Furrow Board, Shield Board, E the Sheath, F the Share Iron, G the Coulter, H the Plough Pin and Collar Links, I the Plough Pillow, K the Wheels."

With these various forms may be compared those represented in Figs. 2245-2247; and also all the modern implements shown and described in the succeeding pages.

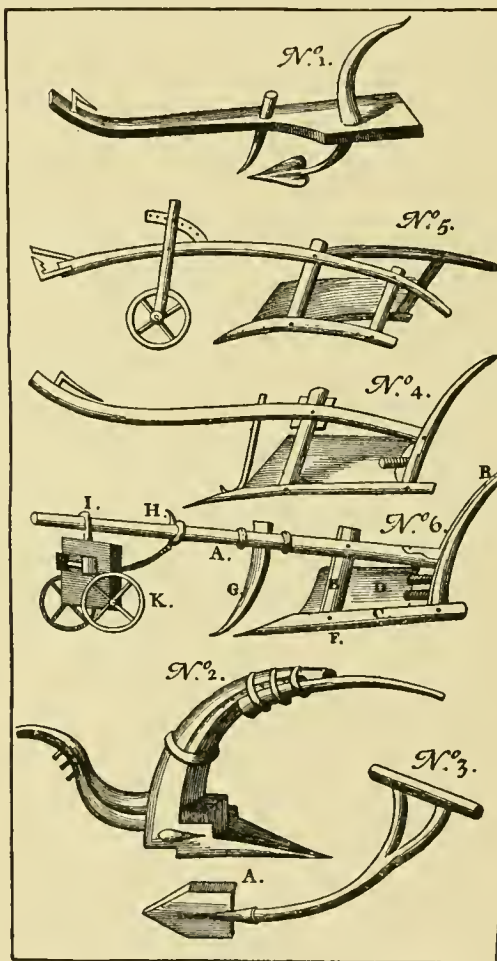
The hoe and the plow, and their many modifications, are still the fundamental or primary tillage tools, one being for hand-work essentially what the other is for power-work. As the necessity of tillage has come to be better understood, these tools have been greatly improved. It is surprising to know that the plow was not perfected until within a century. It is doubtful whether the invention of any of the most important machines of modern times has really meant so much for the welfare of the race as the development of this humble implement. To many persons is ascribed the credit of the invention of the modern moldboard plow, for the implement seems to have originated independently in different countries, and even in America there are various contestants for the honor. Thomas Jefferson, Charles Newbold, David Peacock, and others have been accorded the honor. There is reason for ascribing the modern type of plow to Jethro Wood, of Scipio in Cayuga County, New York. The years 1814 and 1819 are the dates of his most important patents, although the latter is usually regarded as the natal day of the implement. Wood was born in Massachusetts in 1774 and died in 1845 or 1846. (See "Jethro Wood, Inventor of the Modern Plow," by Frank Gilbert, Chicago, 1882.) The study of plows is a curious and profitable undertaking, and one that still needs to be prosecuted.

The large-area farming of North America and the apprehension of the principles that underlie tillage have resulted in the invention of a great number of surface-working tillage tools. These inventions are particularly important in orcharding, as they enable the grower to maintain the necessary surface mulch with small expenditure of labor and without training the trees too high. There are now many cultivators and harrows that cover a wide space and that are adapted to the light stirring of the surface soil without the turning of furrows and the ridging of the land. One who contemplates a serious study of tillage tools should familiarize himself with the inventions of Jethro Tull, before the middle of the eighteenth century. Tull devised implements to facili-

tate the tillage of plants when they were growing in the field. See *Cyclopedia of American Agriculture*, Vol. I, page 374.

In hand-tillage tools, the recent development of the wheel-hoe is significant for horticultural operations. This light and simple tool, usually with adjustable blades, performs the labor of many sets of fingers and does the work more effectively so far as tillage is concerned. It also enforces better initial preparation of the land in order that it may do its work more perfectly; and this remark will also apply to the modern seed-sowers.

There has been surprisingly little authoritative early writing on machinery and implements. Practically, our



2244. Ancient plows.

only sustained effort in that direction for many years was Thomas' "Farm Implements and Machinery," 1859 and 1869. Very recently, the subject has been taken up in the colleges of agriculture and elsewhere, and important reports and books are now available.

L. H. B.

The present symposium on machinery and implements in their horticultural relations comprises the following discussions:

- Tillage machinery (Trullinger), page 1942.
- Tools for the orchardist (Alderman), page 1949.
- Machines and implements in vegetable-gardening (Corbett), page 1953.
- Brief lists of implements for greenhouse and grounds (Thilow), page 1955.
- Spraying machinery and tools (Anthony), page 1956.

Tillage machinery.

Soil-tillage may be briefly defined as the art of preparing the land for the seedling and growth of a crop and of maintaining the necessary conditions until the crop has matured. The entire process of tillage for a certain crop consists of several more or less related but nevertheless distinct operations. The agricultural tools



2245. An early Yankee plow, made of wood and the moldboard protected by iron nailed on. (After Roberts)

and machines which are especially adapted for the different tillage operations, and used in them are known as tillage machinery.

Purpose of tillage.

The different tillage operations form a chain, each link of which is necessary because it accomplishes one or more of the objects of tillage. The chief of these as stated in other works may be enumerated as follows:

1. To produce a deep, thorough, and uniform granulation, giving a well-marked crumb structure.
2. To regulate soil-ventilation, moisture-content, and temperature.
3. To destroy and prevent the growth of weeds and other undesirable vegetation.
4. To effect the deep and thorough incorporation of organic matter.
5. To make available the maximum amount of plant-food required by the particular crop.

In short, the object of tillage is to make the soil physically and chemically fit for crop-growth. Tillage is in itself a mechanical operation, producing at first only physical effects on the soil as shown above by the first four objects. The proper combination of these objects, however, results in the chemical transformation of certain soil compounds and the setting free of a certain amount of plant-food elements for direct assimilation by the crop. Proper tillage is, therefore, of the utmost importance in crop-growing, as it has to do with both the housing and nourishing of the crop.

Different tillage operations.

Tillage operations may be divided into two types or classes according to depth, as (1) plowing or breaking and (2) surface or comparatively shallow cultivation.

The first type of tillage may be applied to the breaking of virgin sod, the plowing under of stubble, or merely the plowing of land often plowed before. Plowing, however, may be considered as the basic operation of tillage. It is the first and most extensive step in the preparation of the soil for the crop and on its depth depends largely the extent of the physical and chemical perfection of the soil with reference to the crop. Furthermore, the success of the second type of tillage

operations depends largely on the first type and, in fact, from the standpoint of economical and efficient soil management, the second type of operations is of relatively little use without being preceded by the first type. Although the second type of operations may be repeated a number of times until the proper depth of effective tillage is reached, it has been demonstrated in this country, and in Europe particularly, that such a method of procedure is usually impracticable.

Max Ringelmann, of the *Institute Nationale Agonomique*, Paris, distinguishes between the two types of tillage operations by calling the first type *real-tillage* and the second type *pseudo-tillage*. According to this classification, *real-tillage* consists in cutting, inverting and partially pulverizing the soil by plowing. The tough sod of the virgin prairie is turned over in a more or less compact slice and much of the dense poorly aerated texture remains. This necessitates the intensifying of the *pseudo-tillage* operations until the virgin soil is reduced to the well-aerated, loose, crumbly, and productive structure of the well-cultivated soil.

Stubble land is not only cut and inverted by *real-tillage*, but is usually pulverized to the desired texture much more extensively than is virgin land. Theoretically the *pseudo-tillage* need not, therefore, be quite so intense to produce the proper tilth, although in practice it can hardly be overdone. On land often plowed before, *real-tillage*, theoretically, should produce even greater pulverization than on the other two kinds of land. But, as a matter of fact, many such soils have been so repeatedly cultivated that they require progressively deeper plowing and intensive *pseudo-cultivation* in order to maintain the standard of good tilth.

Pseudo-tillage consists mainly of the operations of harrowing, rolling, packing, clod-smashing, weeding, and stirring and pulverizing the surface soil generally. The pulverizing function is the main one in *pseudo-tillage* as it tends to improve ventilation and moisture-conservation.

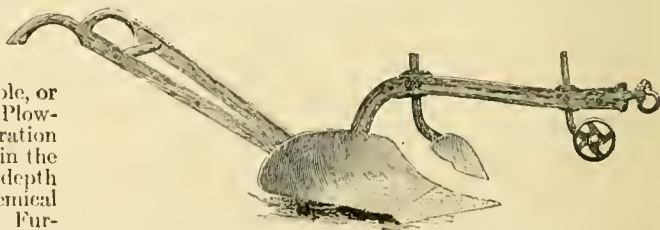
The rolling and packing function is perhaps next in importance and it is especially important in the drier localities from the standpoint of moisture-conservation.

In accordance with the above, then, the plow is the basic tillage tool and is the sole implement used in the first type of tillage, while the several forms of surface cultivators, including harrows, weeders, rollers, packers, cultivators, scarifiers, and pulverizers, constitute the list of machines used in *pseudo-tillage*.

The moldboard plow (Figs. 2245-2251):

The plow, without question, stands first among tillage implements. Historically it is probably one of the oldest of farm implements and from the standpoint of evolution its advance has been slow and its changes profound.

The evolution of the plow is here quoted from Davidson and Chase "Farm Machinery and Farm Motors," New York and Lon-



2247. The perfected American plow.

don, 1908: "The first plow was simply a form of hoe made from a crude stick of the proper shape to penetrate and loosen the soil as it was drawn along, . . . The records of the ancient Egyptians illustrate such a plow.

"At an early time the point of the plow was shod with iron. Virgil describes a Roman plow as being made of two pieces of wood

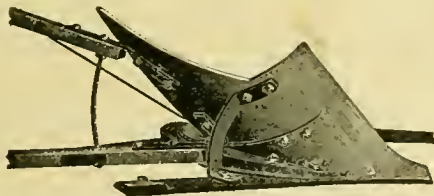


2248. Moldboard view of a steel moldboard walking-plow showing beam wheel.

meeting at an acute angle and plated with iron. During the middle ages there was but little improvement over the crude Roman plow as described by Virgil. The first people to improve the Roman plow were the Dutch, who found that a more perfect plow was needed to do satisfactory work in their soil. The early Dutch plow seems to have most of the fundamental ideas of the modern plow in that it was made with a curved moldboard and was provided with a beam and two handles. The Dutch plow was imported into Yorkshire, England, as early as 1730 and served as a model for the early English plows.

"Howard was one whose name may be mentioned among those instrumental in the development of the early English plow. . . . James Small, of Scotland, was another who did much toward the improvement of the plow. Small's plow was designed to turn the furrow smoothly and to operate with little draft. Robert Ransome, of Ipswich, England, in 1785 constructed a plow with the share of cast-iron. In 1803, Ransome succeeded in chilling his plows, making them very hard and durable. The plows of Howard and Ransome were provided with a bridle or clevis for regulating the width and depth of the furrow.

"Before the Revolutionary War, the plows used in America were much like the English and Scottish plows of that period. The plow used during the later Colonial period was made by the village carpenter and ironed by the village smith with strips of iron. The beam, standard, handles, and moldboard were made of wood and only the cutting edge and strips for the moldboard were made of iron. Among those in America who first gave thought to the improvement of the plow was Thomas Jefferson. Daniel Webster is another prominent American who, history relates, was interested in the development of the plow. He designed a very large and cumbersome plow for use upon his farm. It was over 12 feet long, turned a furrow 18 inches wide and 12 inches or more deep, and required several men and yokes of oxen to operate it. Charles Newbold, of Burlington, New Jersey, secured the first letters patent



2249. Bottom view of steel moldboard plow.

on a plow in 1797. Newbold's plow differed from others in that it was made almost entirely of iron. Jethro Wood gave the American plow its proper shape. The moldboard was given such a curvature as to turn the furrow evenly and to distribute the wear well.

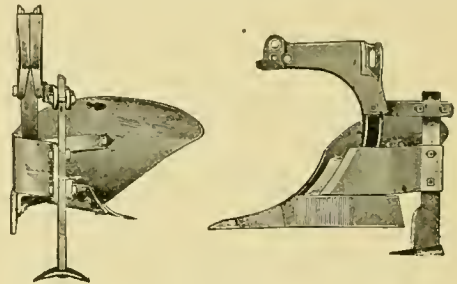
"As farming moved farther west the early settlers found a new problem in the tough sods of the prairie states. A special plow with a very long sloping moldboard was found to be necessary in order to reduce friction and to turn the sod over smoothly. Owing to the firmness of the sod it was found that curved rods might be substituted for the moldboard. Later, when the sod became reduced, it was found that the wooden and cast-iron plows used in the eastern portion of the country did not acour well. This difficulty led to the use of steel in the making of plows. Steel, having the property of taking an excellent polish, permitted the sticky soils to pass over a moldboard made of it where the other materials failed.

"In about 1833 John Lane made a plow from steel cut from an old saw. Three strips of steel were used for the moldboard and one for the share, all of which were fastened to a shin or frame of iron. John Lane secured in 1863 a patent on soft-center steel, which is used almost universally at the present time in the making of tillage tools. It was found that plates made of steel were brittle and warped badly during tempering. Welding a plate of soft iron to a plate of steel was tried and although the iron supported the steel well when hardened it warped very badly. The soft-center steel, which was formed by welding a heavy bar of iron between two bars of steel and rolling all down into plates, permitted the steel to be hardened without warping. It is very strong on account of the iron center which will not become brittle.

"In 1837 John Deere built a steel plow from an old saw which was much similar to Lane's first plow."

The modern steel moldboard plow is a three-sided wedge which is pulled through the soil by means of a beam and held steady by two handles behind. (Figs. 2248-2250.) The main parts of the plow may be enumerated as follows: (1) The share, or cutting edge, of which the point is the part first penetrating the soil, and the heel is the outside corner; (2) the moldboard, forming a twisted face which turns the furrow; (3) the landside, which receives the side pressure produced when the furrow is turned and aids in preventing the furrow from becoming crooked, particularly when irregularities in the texture of the soil are encountered; and (4) the frog, or metal shape to which the moldboard, landside and share are attached.

The functions of the plow with reference to the soil are a cutting function, an inverting function, and a pulverizing function. The cutting of the soil is effected



2250. Landside and back view of steel moldboard plow, showing subsoiling attachment.

in two planes, one vertical and the other horizontal. The inversion of the furrow-slice requires first a lifting and then a rolling of the slice to one side, bottom up. The pulverizing of the slice of soil is effected by bending the slice upon itself more or less abruptly and then dropping it suddenly upon the ground, the intensity of which effect is governed largely by the shape of the moldboard.

In general, there are two extreme types of moldboard plow, namely, the breaker and stirring plow. Between these extremes occur several intermediate forms to meet all soil conditions. The average, or medium, of these is the so-called general-purpose plow.

The breaker (Fig. 2251) has a long low moldboard with no abrupt curvature which turns the slice of tough virgin sod gradually with minimum friction and effects little or no pulverization. This type of plow has been adopted for breaking tough prairie land owing to the advantage as regards draft over the other types. In some of the breaker plows the moldboard is replaced by rods bent to the shape of the moldboard, thus further reducing friction and consequently the draft.

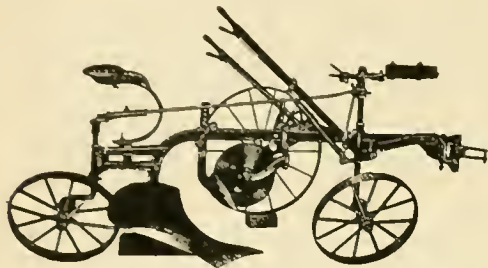
The stirring or stubble plow has a short, high, and rather wide moldboard with an abrupt curvature, which turns the furrow-slice of old soil over suddenly and produces the maximum pulverization for a plow in that particular soil.



2251. Types of moldboard plows adapted to different kinds of plowing: 1, prairie breaker bottom; 2, rod breaker bottom; 3, stubble bottom; 4, general-purpose bottom; 5, black land bottom; 6, tame sod breaker bottom.

The general-purpose plow strikes an average between these two as regards shape and operation, and may be used either in stubble or light sod.

Deep plowing is objectionable in some soils, particularly in those having a sand or gravel subsoil, owing to the fact that it is inadvisable to bring this subsoil



2252. Deep-tilling plow equipped with jointer and coulter.

material too near the surface. Such soils may, however, be plowed deeply if the proper plow is used. Fig. 2252 illustrates a deep-tilling plow, which, it is asserted, is adapted for the deep pulverization of a soil, the sub-surface soil of which should not be brought to the surface. It has a broad share and the moldboard is very narrow at the point where it joins the share but widens gradually at the upper end. The share loosens and pulverizes the bottom part of the furrow-slice which then falls through the space between the outer edge of the moldboard and the wing of the share, thus preventing its being brought to the surface. The broad part of the moldboard turns the upper part of the furrow-slice in the usual way.

The material of the plow-beam may be either of wood or iron. While the iron beam is perhaps lighter and more wieldy than the wooden beam, it is likely to bend out of shape when the plow strikes a root or stump. The wooden beam will probably break under the same circumstances and can be replaced. The steel beam is curved over the moldboard and down to the landside. The wooden beam is fastened to the plow by a beam standard. The plow-handles are usually of wood and are fastened to the beam.

A beam-wheel (Fig. 2248) is usually fastened to the plow beam, the function of which is to aid in regulating and maintaining the depth of plowing. Its proper adjustment is secured when it simply rolls on even ground without carrying weight.

The more common types of coulter (Figs. 2253, 2254) are the knife and rolling types. The coulter is used chiefly in sod-plowing but may be used in any soil. When the coulter is thick, dull, and improperly located on the beam it is likely to increase the draft. If, however, it is so located just behind the plow point as to cut directly above where the point and share are cutting and lifting the soil, the two parts of the plow should assist each other materially. When the ground is covered with wet corn-stalks, the rolling coulter should usually be set high and slightly back of the point. In very trashy ground it is often advantageous to set the rolling coulter well forward, but not on very hard ground. For stubble ground the rolling coulter had best be set about $\frac{5}{8}$ inch outside of the landside and run one-third to one-half the depth of the furrow. For shallow



2254. Rolling coulter.



2253. Knife coulter fastened to plow beam.

plowing in sod, it may be set closer to the landside and should run the entire depth of the furrow.

The jointer (Fig. 2252) should be used when there is trash or organic matter on the surface which is not thoroughly covered. This implement is attached to the plow-beam in front of the plow and can be gaged to any required depth. As the trash is turned, it strikes the previous furrow a little below the top and is completely



2255. Subsoil plow.

covered by the furrow-slice as it turns from the mold-board. In this way trash, and the like, is completely covered but not too deeply. Sod especially can be deep plowed when the jointer is used.

It is often necessary to use a subsoil plow when the soil conditions are such that deep plowing is out of the question. The modern subsoil plow (Fig. 2255) is built more or less on the principle of a coulter. It cuts a narrow gash in the soil, the depth of which is regulated by a beam-wheel, and the small point forms a sort of reservoir for water. The subsoil is thus aerated and the capillarity is generally improved.

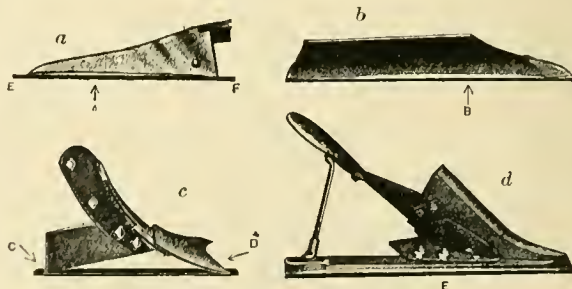
In regard to the operation of walking-plows, it may be stated that a walking-plow is very sensitive to soil conditions, depth of plowing, the nature of the hitch,

the set of the coulter or of the beam-wheel, and the set of the share. A walking-plow should usually be balanced about the point and run level. The proper set of the share point to secure penetration is shown in Fig. 2256a. There should be $\frac{3}{16}$ to $\frac{1}{4}$ inch of suction at point A. Hard plowing requires slightly more suction. Fig. 2256b shows the clearance in the throat of the share, which

should be about $\frac{1}{8}$ inch at point B.

Walking-plowshares have what is called a wing bearing. That is, a straight edge as shown in Fig. 2256c when placed at the rear of the landside point C and extending to the wing of the share point D should touch the share bottom from $\frac{3}{4}$ inch to $1\frac{3}{4}$ inches back of the edge, according to the size of the plow. The point of the share is also turned outward to the land to cause the plow to follow directly behind the team. As shown in Fig. 2256d, the clearance at E should be about $\frac{1}{8}$ inch.

The plow must scour in order to operate satisfactorily; that is, the share and moldboard must be of hard material taking a smooth polish so that the furrow-slice



2256. Plow adjustments.

slips smoothly off without sticking. The plow must, therefore, be carefully polished and not allowed to rust. If the face is of good hard metal, hard soil-grains cannot scratch it.

The plow must also be properly adjusted and the share and mold-board joined perfectly in order to insure perfect scouring.

The riding-plow is more convenient than the walking-plow and generally does better work,

particularly in dry soils. Two general types, the frame and frameless, are made. The frame plow (Fig. 2257)

has its wheels attached to a frame which is connected to the plow-beam by "bails." This arrangement permits the lifting of the plow within the frame and the beam may be "floated" so that if the plow strikes a rock or other obstruction the plow only is raised and not the frame and the operator. The frameless plow (Fig. 2258) has no special frame-work and the wheels are attached directly to the beam by means of wheel brackets.

In the riding-plow, the side and downward pressure due to turning the furrow-slice is carried by the wheels and not as sliding friction, as in the walking-plow. It will be noted that the furrow-wheels are set at an angle better to carry the landside pressure. The rear furrow-wheel is usually turned a little from the unplowed land and in order to reduce the pressure on the landside is set toward the unplowed land 1 to 1½ inches beyond the landside. The front furrow-wheel is turned toward or from the unplowed land, according to the number and arrangement of the horses, and serves as a sort of side-draft equalizer. The plow is given the same suction as a walking-plow and the landside heel is raised about ½ inch from the furrow-bottom. The point is set the same as for a walking-plow.

A sulky gang-plow is one having two or more plow-bottoms, so that two or more furrows may be plowed at one operation. Fig. 2259 illustrates a sulky gang-plow. A subsoiling attachment (Fig. 2250) is sometimes attached to one of the bottoms of a double gang-plow so that alternate furrows may be subsoiled.

The disc-plow (Fig. 2260) is the result of an attempt to reduce plowing draft due to sliding friction. In ordinary soils it has been found to have no material advantage over the moldboard-plow and the draft is in some cases greater. In sticky or very hard dry soils, however, it usually has the advantage over the moldboard-plow and operates with less draft.

The harrow.

The harrow is perhaps second in importance to the plow as a tillage implement. While the plow breaks the soil and pulverizes it in a general way, the harrow does finer work by breaking up clods and pulverizing the soil in detail. The original harrow was a tree limb with most of the branches extending on one side. Other early types were a forked limb with spikes driven in each arm and a rectangular-shaped frame having cross-bars each containing several teeth.

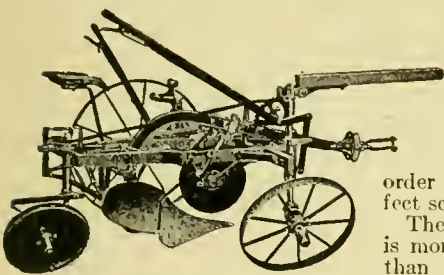
The main purposes of the harrow as a tillage tool may be enumerated as follows: (1) To effect pulverization and to secure a uniform soil-texture; (2) to destroy young weeds; (3) to improve soil-aëration; (4) to smooth the soil-surface; (5) to check evaporation; (6) to prepare a shallow seed-bed; (7) to cover seed; and (8) to mix manure with the surface soil.

Harrowes may be grouped under perhaps three distinct types, according to the work they accomplish, as toothed- or smoothing harrows, disc-harrowes, and curved-knife, clod-crusher, or pulverizer-harrowes.

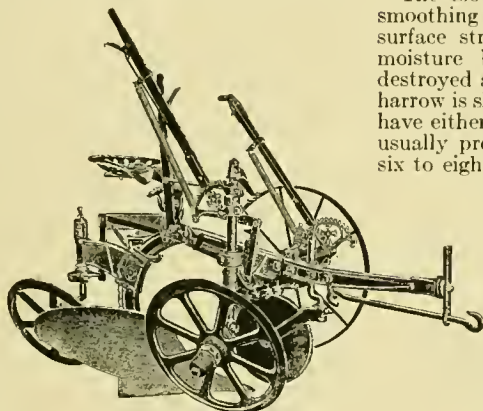
The toothed-harrow is effective in pulverizing and smoothing the surface soil of plowed ground. The fine surface structure produced tends to prevent loss of moisture by evaporation. Young weeds are also destroyed at a tender age. A common type of toothed-harrow is shown in Fig. 2261. The toothed-harrow may have either wood or steel tooth-bars, but the latter are usually preferable. The number of teeth varies from six to eight to a foot of width and these vary slightly in size for light and heavy soils. The lever enables the operator to incline the teeth forward for penetration and pulverization and backward for smoothing.

A steel harrow riding-cart is now used which may be attached so as to follow the harrow. Its wheels are made to caster to facilitate operations in turning. The harrow cart is a desirable adjunct to the harrow as it saves the hard labor of walking over plowed ground, and if properly constructed with wide-tired wheels does not cause an excessive increase in draft.

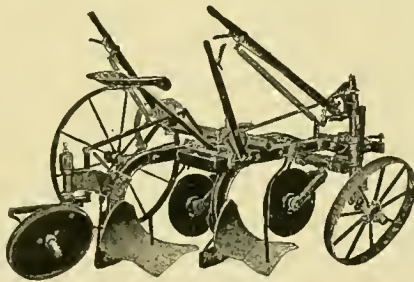
The disc-harrow is an implement of varied utility. It is especially adapted for rather deep surface-cultivation. One of its main uses is for preparing a seed-bed in plowed ground. It is likewise useful for preparing stubble or sod for plowing and for reducing sod after plowing. It is also useful as a general soil-pulverizer, for covering broadcasted seed in stubble, and for destroying weeds. In fact, many of our foremost agriculturists state that on an up-to-date farm the disc-harrow is indispensable.



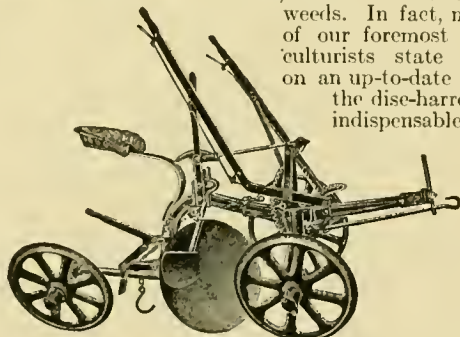
2257. Frame riding-plow.



2258. Frameless riding-plow.

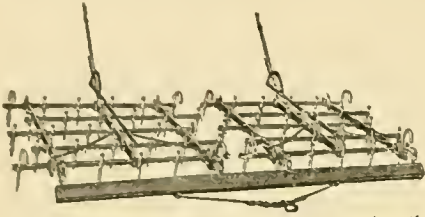


2259. Riding gang-plow.



2260. Single disc-plow.

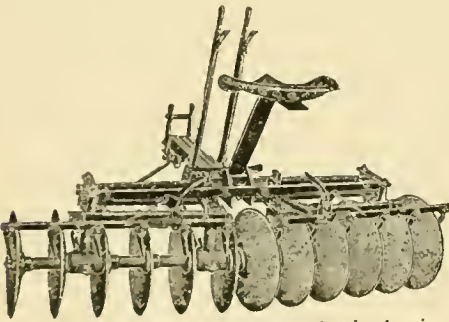
In Fig. 2262 is illustrated a common type of disc-harrow called the full-bladed type. The diameter of the discs usually varies from 12 to 20 inches and the harrow width usually covers from 4 to 10 feet. The depth of penetration of the discs is governed chiefly by



2261. Common type of toothed harrow with metal tooth bars.

the curvature and sharpness of the discs, the angle of the gangs, and the weight of the harrow.

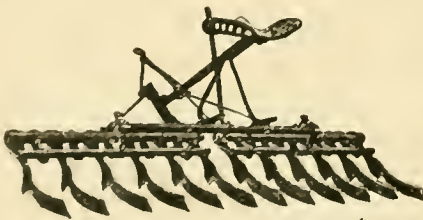
The disc-harrow bearings are usually of wood, oil-soaked maple being preferred. The friction between wood and iron is less than between two pieces of iron, hence the value of wooden bearings. The end thrust of each gang is usually taken care of mainly by the bumpers between the gangs. The couplings between the main frame and the bearing-box casting are usually so arranged that the bumpers will come together with



2262. Common type of disc-harrow, showing bearings and scraper.

the angling levers in any position. The individual discs are usually set about 6 inches apart. The scraper for cleaning the discs may be made stationary or to be operated by the driver. A special type of disc-harrow for use in orchards has the disc-gangs widely separated so as to cut under trees without injuring the branches.

The cutaway disc-harrow differs from the full-bladed type in that notches are cut out of the discs to permit deeper penetration. It has been found, however, that the pulverization is not so complete with this type as



2263. Curved-knife harrow or clod-crusher.

with the full-bladed disc-harrow. It has a further disadvantage in that the discs are difficult to sharpen since each disc must be removed and ground. Its principal use seems to be for renovating hay land and old pastures.

A type of curved-knife harrow or pulverizer is illustrated in Fig. 2263. This is often called the Acme har-

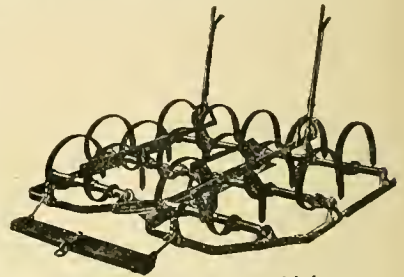
row. The slanting curved knives are effective in crushing clods, leveling the surface, destroying small weeds, and in producing the uniform soil structure so desirable for a seed-bed. Some of these implements have a set of rake-teeth following the knives, the purpose of which is to complete the pulverizing and smoothing process.

The so-called spring-toothed harrow illustrated in Figs. 2264, 2265, while in one sense a harrow, is really a cultivator. It is an implement which has been in more general use in Europe than in this country. The long spring teeth when striking a stone or root are easily released, thus making this implement effective in bad ground. It effects considerable pulverization but is said to have a rather excessive draft.

The weeder.

Weeds in a seed-bed or between crop-rows have been found to use up considerable moisture and plant-food. The plow and harrow serve to destroy many weeds, particularly the latter.

Special weeder implements are, however, in use. These usually combine surface-cultivation with the destroying of weeds. One type used on seed-beds has a large number of rather long teeth with flattened and curved points which tear out and destroy weeds and pulverize or scarify the surface soil.



2264. Spring-tooth harrow, with frame.

A second type, used between the rows of truck and root crops, is in reality a combination horse-drawn hoe, weeder, and cultivator. The hoes are broad and flat and by passing almost horizontally just beneath the surface of the soil, cut off and destroy weeds and at the same time form more or less of a surface mulch.

The roller, or packer and planker.

The roller as originally used was a tree-log. This, however, did not operate satisfactorily. Wrought- and cast-iron rollers succeeded the wood and they are now also made of concrete in some cases. Like the disc-harrow, rollers and packers usually have wooden bearings to reduce the friction.

While fairly deep general pulverization of the soil is desirable, the loose mellow seed-bed should be rather shallow and the plowed soil below be well packed to conserve moisture.

The iron roller (Fig. 2266) not only compacts the soil but effects considerable pulverization in the way of smashing clods. The smooth surface left by the roller, however, while desirable from the standpoint of mowers, binders, and so on, permits excessive surface evaporation and consequent loss of soil-moisture. This condition is remedied somewhat by following the roller immediately with a harrow, thus producing a surface mulch and breaking up evaporation.

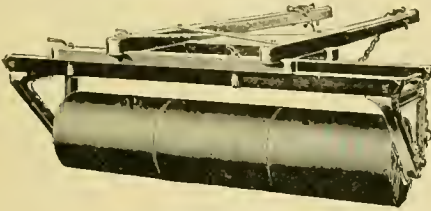
The roller pulverizer or pulverizer-packer (Fig. 2267) may perhaps be used to better advantage than the smooth roller. This type of roller compacts the subsurface soil and pulverizes the surface



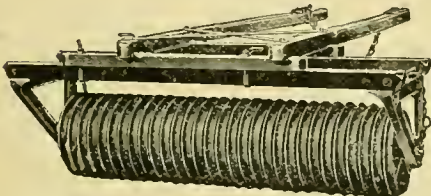
2265. Another form of spring-tooth harrow.

soil, leaving more or less of a mulch to prevent evaporation. Similar claims are made for corrugated and tubular rollers.

A so-called subsurface packer, consisting of a series of wheels with wedge-shaped tread, is on the market, for which many claims are made.



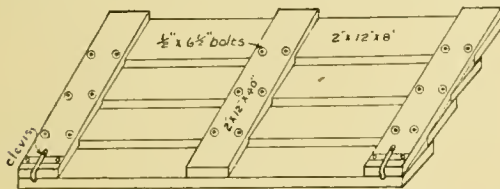
2266. Iron roller.



2267. One form of roller pulverizer or packer.

The Montana Experiment Station has been instructing the farmers of the state how to make their roller pulverizers of concrete. A circular has been issued describing and illustrating this method in detail. It is stated in this circular that the roller should weigh not less than 225 to 250 pounds to a foot of width. This is provided the roller is not used on moist soil. The concrete roller described is about 19 inches in diameter.

The planker (Fig. 2268) or clod-smasher is a home-made wooden implement which is very useful for crushing clods and for surface-smoothing. In fact, on some Hawaiian soils the wooden planker has been successful in pulverizing the top soil when both the disc- and Acme harrows have failed. The planker is effective in listed corn after the first plowing when the soil tends to be cloddy. The weight of the planker may be gaged



2268. The planker.

according to the type of soil. The planker is more generally successful when the surface soil is rather dry. When the soil is wet and sticky, it may cause more harm than good by causing excessive packing of the soil. This also applies more or less to the roller.

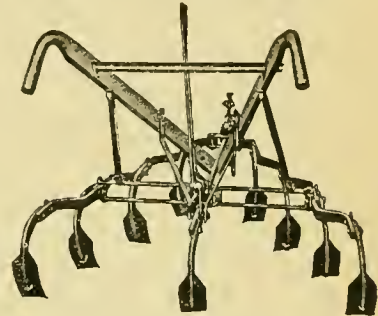
Cultivators.

The term cultivator is applied to a number of tillage tools. These are surface tillage tools but are usually equipped with shovels or discs instead of teeth and some of them till the soil to a slightly greater depth than the harrow.

Cultivators are more generally used between the rows of growing crops, corn in particular. Corn-stubble is, however, frequently cultivated in the spring with a corn-cultivator previous to listing the corn. The main purpose of cultivators is to destroy weeds, pulverize and ventilate the soil, and thereby conserve moisture and plant-food.

The cultivator has developed from the single-shovel and double-shovel cultivator, which cultivated only one side of a row, to the single straddle-row and double straddle-row types. The single- and double-shovel types have also developed into cultivators having from five to fourteen shovels which are used for cultivating between two rows.

These are used almost exclusively now for garden and truck crops. Fig. 2269 illustrates a common type of garden cultivator. These are made for both horse- and hand-power.



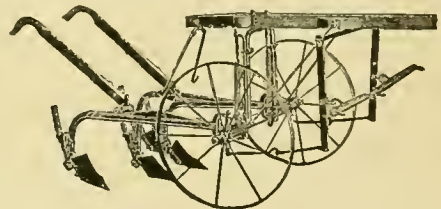
2269. Garden or truck cultivator.

Corn-cultivators are of several types. There are single-row walking-cultivators with and without tongues, and single-row and double-row cultivators. The tongueless or "speechless" walking-cultivator is a rather old type and its use in the corn-belt now is rather limited. When standing still it was likely to fall in a heap if not held steady.

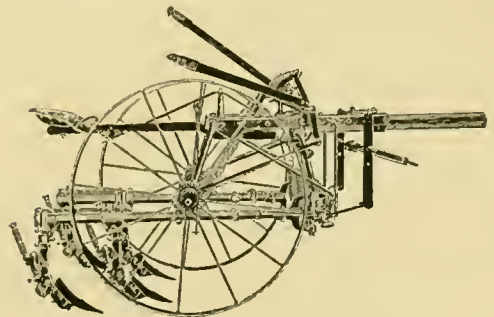
The single-row four-shovel walking-cultivator with a tongue (Fig. 2270) is a very effective corn-cultivator, particularly for second plowing. However, a strong man is required to operate a walking-cultivator, especially during second plowing when considerable care is required not to injure the corn and at the same time to effect thorough cultivation and destroy weeds.

Riding-cultivators are in very general use now for corn-cultivation. Fig. 2271 illustrates a common type of four-shovel single-row riding-cultivator. The shovel gangs are hung on springs and the shovels themselves are also sometimes fitted with springs better to withstand shock. The operator regulates the depth of the shovels by hand levers, maintains the required depth, and guides the gangs with his feet, the guiding being frequently aided by a hand lever.

Corn-cultivators now have four, six, eight, and sometimes ten shovels. While the four-shovel types do very good work, the six-shovel types effect a rather more



2270. Walking single-row four-shovel tongue cultivator.



2271. Riding single-row four-shovel cultivator.

intensive cultivation. In the opinion of many farmers in the corn-belt, increasing the number of shovels over six not only increases the draft but the difficulty in operating. The cultivator shovels are bolted directly to a shank. The shank is usually attached to the beam so that it may be raised or lowered. Where no provision is made for taking the shock caused by the shovel striking stones, roots, or stumps, the shank is hung by one bolt and fastened into place by means of a wooden peg. Thus when the shovel strikes an obstruction, the wooden peg breaks and allows the shovel and shank to

But at the time of second plowing the weeds are usually thicker and the soil drier and harder so that the operation is usually a difficult one. The third plowing is often the "laying by" plowing. Corn is, however, often not laid by until the fourth and sometimes the fifth plowing. At this plowing the shovels are turned so as to throw the soil toward the corn, hilling it up around the roots. An objection made to the shovel-cultivator for laying by is that it cuts the corn roots. A surface cultivator is now used for this purpose which, it is claimed, does not cut the corn roots but throws

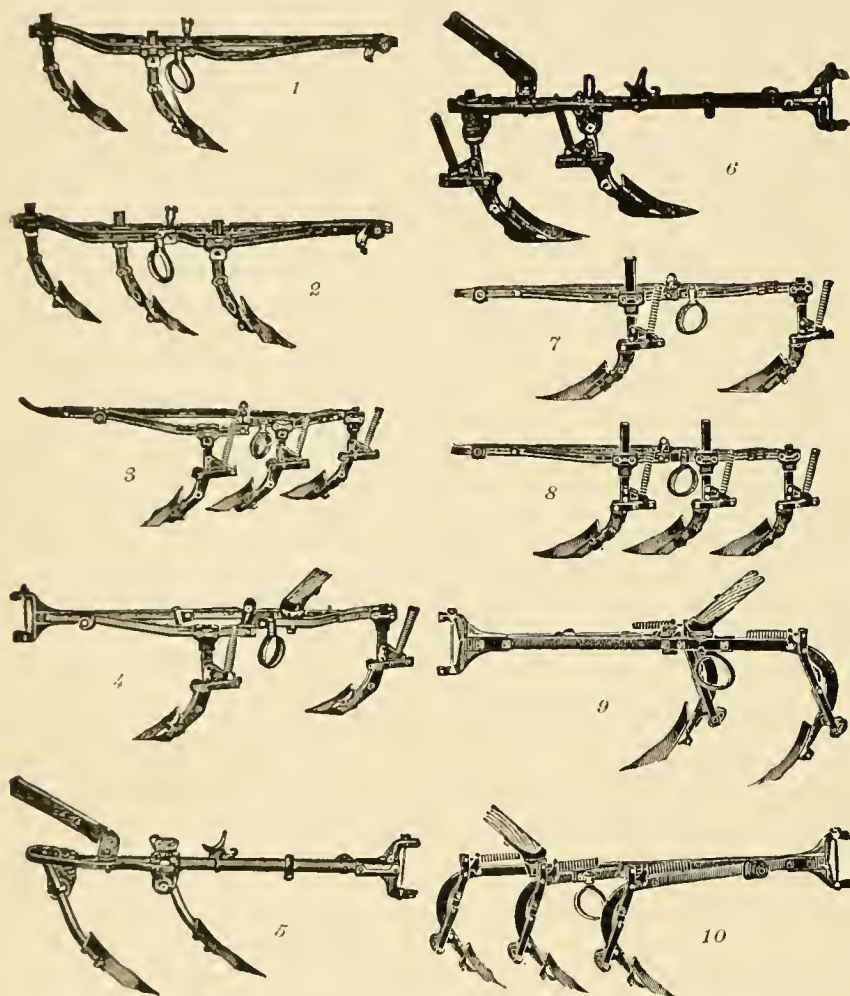
the earth well toward the corn. Fig. 2273 illustrates a cultivator of this type.

Disc-cultivators are also used for cultivating corn and other row crops. The discs may be regulated to throw the earth toward, or away from, the corn. Fig. 2274 illustrates a cultivator of the disc type. Another type of single-row cultivator is the single-row "go-devil" which is equipped either with curved knives or discs and operates usually on wooden runners. This cultivator is often used for the first and second cultivation of listed corn. Fig. 2275 illustrates a "go-devil" of the disc type.

Two-row cultivators of both the disc and shovel types are now in use. It has been found that these implements require considerable practice for satisfactory operation. In addition, the rows must be straight and parallel and the weeds few. It is difficult to cultivate satisfactorily where irregularities in the rows are encountered. The draft also is practically double that of a single-row cultivator. On the other hand, it is contended that they do good work under proper conditions. The writer's experience with a two-row disc-cultivator in listed corn was satisfactory for the first plowing. Fig. 2276 illustrates a two-row combination disc-and shovel-cultivator. There are many such combination machines in use on single-row work, especially for listed corn. Fig. 2277 illustrates a two-row shovel-cultivator.

There are many other special types of cultivators adapted to different special kinds of work. Fig. 2278 illustrates a cultivator which is especially adapted to orchard cultivation. It is impossible here to cover all the types, but they all have practically the same purpose in view.

It is important that cultivators be well taken care of and that their operation and adjustment be studied so as best to adapt them to the requirements of a certain kind of cultivation. Cultivator shovels should be



2272. Different types and arrangements of cultivator gangs: 1, steel beam, four-shovel; 2, steel beam, six-shovel; 3, steel beam, V-spring trip, six-shovel; 4, steel beam, V-spring trip, four-shovel; 5, pipe beam, four-shovel; 6, pipe beam, spring trip, four-shovel; 7, steel frame, V-spring trip, four-shovel; 8, steel frame, V-spring trip, six-shovel; 9, steel beam, universal spring trip, four-shovel; 10, steel beam, universal spring trip, six-shovel.

turn back without breaking the beam. Fig. 2272 illustrates several arrangements of cultivator gangs.

Corn is usually cultivated three or four times. At the first cultivating the corn is usually very small and the operation consists mainly of killing weeds and stirring the soil. The shovels are usually turned so as to throw the soil away from the corn, and fenders are provided to protect the corn from clods and soil which are thrown toward it as the cultivator shovels tear through the soil. At the second plowing the shovels are not turned quite so much and it depends largely on the size of the corn whether the protecting fenders are used.

kept in good condition. They should scour the same as the moldboard-plow and should, therefore, not be permitted to become rusty. They are usually soft-centered with hard smooth face.

Conclusion.

It has been attempted in the above to describe only those tillage implements which have long been in common use on progressive farms and have undergone a steady development, and to illustrate examples of common types, not to recommend any of them.

The actual construction of the different types is touched on but briefly, but it is hoped that the discussion

will be sufficient to give one at least a general idea as to the common types of tillage tools and their operation. As regards maintenance, it has long been known that tillage implements will not operate satisfactorily if not well taken care of. They should be protected

from the weather and bearings should be well oiled both when in use and when not in use. Scouring surfaces should be protected from rust. And lastly, in the choice of tillage implements, considerable judgment should be exercised. Only strongly built machines should be selected. Bearings should be boxed to protect them from dust and dirt. Convenient and easy adjustment and operation may well be considered. It is also often true that a dollar spent on a good machine is worth several spent on a poor cheap one.

It is thought that a certain amount of study and investigation along the line of tillage machinery will be advantageous to any prospective farmer and may be a source of additional information to the old experienced farmer.

ROBERT W. TRULLINGER.

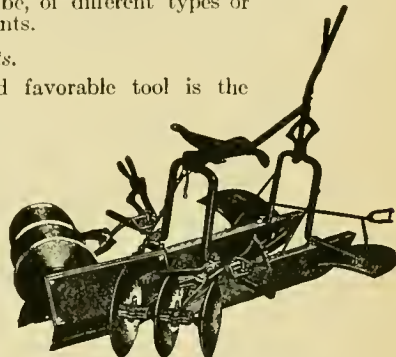
Tools for the orchardist.

Orchard tools may well be classified into three groups,—cultural, pruning, and harvesting implements. The first group comprises, with a few exceptions, the usual agricultural tools commonly used in a region for soil culture and probably require only a brief discussion. The implements used in pruning and in har-

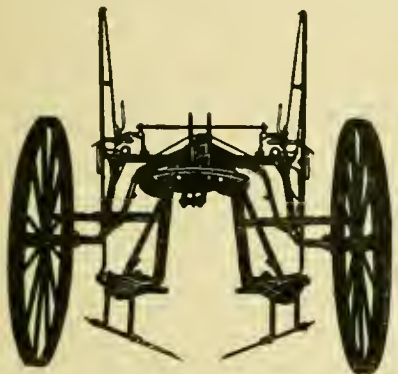
vesting have been developed for a more specialized type of work and should be considered more in detail. No particular brand or make of tools will be recommended in this article but the writer will endeavor in some cases to point out the defects or the good points, as the case may be, of different types or classes of implements.

Cultural implements.

An ancient and favorable tool is the plow, in the long development of which extended engineering skill has been expended. It might be supposed that in its development a highly specialized type would have been evolved for the rather exclusive use of the specialized industry of the fruit-grower. Such, however, is not the case. In the huge mountain orchards of the Appalachian range, one still finds the old shovel-plow used extensively and doing efficient service. Many of the orchards have been planted on newly cleared land and about the only implement which can successfully dodge stumps and tear up the root-bound soil is a strong oak-beamed narrow-pointed shovel-plow. For working the ground close to the tree, a long-beamed shovel-plow is used, so constructed that the plow sets off to one side, enabling both horse and driver to walk well away from the row. Between this crude tool and the heavy three- four- or six-bottom gangs hauled by a tractor, are all kinds of deep-tillage implements used in the orchard. The average fruit-grower with a moderate-sized orchard, carrying a good cover-crop to be worked



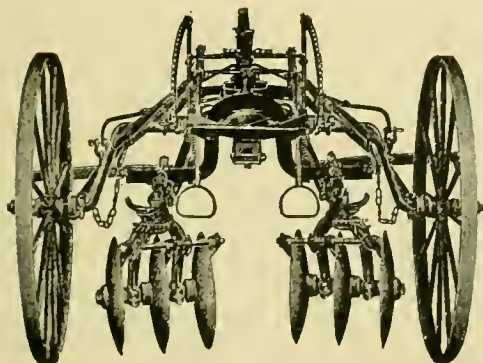
2275. "Go-devil" corn-cultivator.



2273. Surface cultivator.



2276. Double-row disc- and shovel-cultivator.



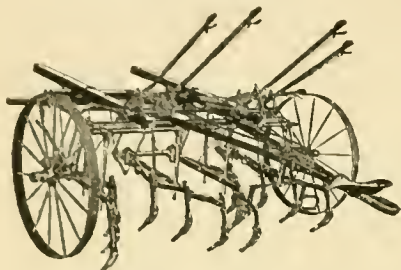
2274. Disc-cultivator.

up each spring, will still cling to the modern two-horse plow. In light soils a cover-crop may be satisfactorily incorporated into the soil with a disc-harrow or a light three-bottom gang-plow.

A tool well adapted for this work is the cutaway type of the disc-harrow. This machine will chop up and work into the soil a heavy cover-crop and put the surface into a fine tilth at the same time. In old sod orchards where the roots are so near the surface that plowing is difficult, the cutaway will often work up the surface into a sufficiently good condition to act as a mulch. It is not advisable to use less than an 18- or 20-inch disc, as the large size is a comfort when heavy work is to be done and the draft for light work is not appreciably greater than in the smaller sizes. For cultivating trees, the reversible extension type is to be preferred, as it enables one to throw earth either toward the trees or away from them.

The greatest advance in cultural implements for the orchard is found in the harrows, cultivators, and the like, used for shallow cultivation to maintain a dust mulch. The advent of low-headed trees brought about the extension harrow adapted for working under low-

hung branches. Not only are extensions used, but in some cases they are covered with guards to lift the branches and prevent injury from contact with the working parts of the harrow. In maintaining the dust mulch, frequent but shallow tillage and a finely pulverized soil are essential. To meet these conditions, the harrow manufacturers have designed wide-cutting but light-draft tools, making it possible to work lightly a



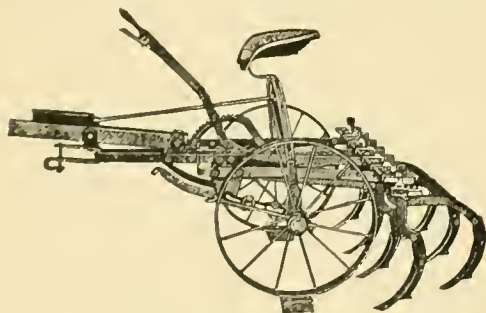
2277. Double-row shovel-cultivator.

large area with a minimum amount of horse-power. Very many forms of teeth are used, some designed for pulverizing, others for leveling and others simply for stirring the surface.

The character of the orchard soil will determine, to a large extent, the type of shallow cultivator used. In soil free from stone or stumps and not uneven as to surface, the light tools, Acme or Kimball type, may be successfully operated, as may also the extra-wide (12 to 18 feet) spike-tooth and spring-tooth harrows. In rough or stony land, or among stumps, the orchardist must be content with the narrow but strongly built float or semi-float spike- or spring-tooth harrows.

The larger orchardists have recently developed an active interest in mechanical power for working the orchard. It seems true unquestionably that the tractor will eventually largely supersede the horse and mule in orchards of 100 acres and over. The cost of horse-labor and man-labor is constantly increasing and the cost of mechanical power is steadily becoming lower, so it seems to be only a matter of time when the latter will come into common usage. At present the tractor is of value only upon comparatively smooth land, free from boulders and stumps.

Some of the lighter tractors, when tested in West Virginia orchards, were unable to stand up under the



2278. Orchard cultivator.

strain. In other cases, the heavier types of tractors developed so much power that it was difficult to get cultural tools strong enough to stand the strain imposed upon them on rough or uneven lands. To strike a boulder or stump would usually mean the breakage of something. Both the "caterpillar" and the ordinary wheel-driven types give good satisfaction when conditions are favorable for their use, and the choice of design depends upon the local conditions.

One interesting development of the mechanical power is found in the motor cultivator. This light and cheap outfit may be attached to almost any two-horse harrow or cultivator and will work efficiently in small orchards where the large tractor might prove unwieldy.

Pruning implements.

The implements used in pruning fall naturally into four classes: hand-shears and knives, long-handled shears, pole-pruners, and saws. No attempt will be made to consider different makes of these implements but the various types of each may be discussed with considerable freedom.

For a pruning-knife, the average orchardist will consider nothing but some sort of pocket- or clasp-knife. Those having rigid blades and handles are both inconvenient and dangerous to carry when not in use. In picking out a clasp-knife for pruning, one should choose either a slightly crooked (hawk bill), or a straight-edged blade. The hook in the blade causes the knife to "hang to the limb" when cutting toward the point and lessens the danger of slipping and cutting the wrong branch. The handle should be fairly thick and large enough to enable one to get a comfortable grip on it. The narrow metal handles sometimes seen are unmanageable and a forerunner of blisters and ill temper.

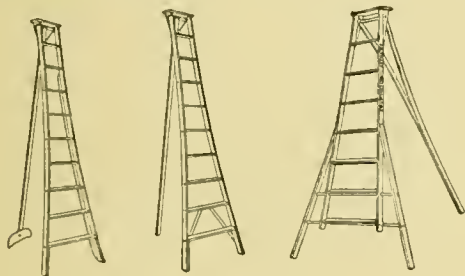
Great ingenuity has been displayed in designing hand-shears, but it seems that more thought has been expended in making an elaborate handle than upon the principles governing an effective cutting blade. Projections, loops and guards upon the handles are only a source of annoyance and hindrance. The simple, graceful, yet powerful handles of the American Rieser and California types are satisfactory and convenient in every respect. A poor spring in the handle will cause much trouble by slipping out or by being easily broken. Experience has demonstrated the superiority of the curved double brass spring over either the round or flat spiral springs. The fact that every catalogue of pruning-shears quotes prices upon extra spiral springs indicates their weakness.

The most important feature in a pruning-shear is the cutting part. The California pattern, which is probably more extensively used than any other, has a rather full rounded blade, well formed for cutting toward its base, but is a trifle too blunt at the point, a feature which sometimes causes it to slip off a limb when not securely gripped. The bluntness or roundness has a tendency to interfere with rapid pruning in young trees by making one open the jaws wider each time to receive the limb nearer the base of the blade. This difficulty has been overcome largely in the Swiss and American Rieser patterns in which the blade is made more tapering. These latter shears are somewhat finer pointed than the California pattern and can be used with greater ease to remove limbs from crowded crotches. With this exception, there is little to choose from between these two excellent types of shears. The French shears give good satisfaction, but have no advantages over the ones above mentioned. The straight-bladed types lack in cutting power and are poorly shaped for working in narrow crotches or where limbs are thickly crowded. The latter objection applies with equal force to the Connecticut and Henry patterns and the parrot-headed type, while one using the Lenin pattern will frequently find it almost impossible to prune closely where limbs are close together. The double-cut pruner has one objectionable feature in the fact that curved blades compel the wide openings of the handles to receive the limb. Anyone who has pruned will recognize how this will slow up the work and unduly tire the hand.

Long-handled shears are designed for lopping off heavier branches than can be cut with the hand-shears.

Much the same principles of blade-construction apply here as in the hand-shears, the thing to be considered being, first, ability readily to grasp the branches even though closely crowded, and secondly, power to make the cut. The draw-cut type is undoubtedly the most powerful and fairly well designed for grasping the limb. These shears are heavily built and the weight is sometimes objectionable. The double-cut type has blades so curved that it requires a wide opening of the handles to accommodate even a small limb. Of the other types, the tapering blade and Cartright patterns are the best, as they combine power and ease of operation through a high degree of efficiency.

Pole-pruners are designed for light pruning on such limbs as might be difficult to reach by hand-pruners and are specially adapted for rather small trees, such as peach, pear, cherry, plum and young apple trees. There are three types,—the pole-hook, pole-saw and pole-shear. Many of these are used in combination on the same tool. The blade in the pole-shear is often too light and is easily sprung out of shape in orchard work. The more elaborate shears and combination tools are usually somewhat cumbersome and unhandy in the orchard. The chisel-points used on some tools are of little if any value. For working in shrubs and brambles, it is difficult to find a more satisfactory tool than the bramble-hook.



2279. Types of step-ladders.

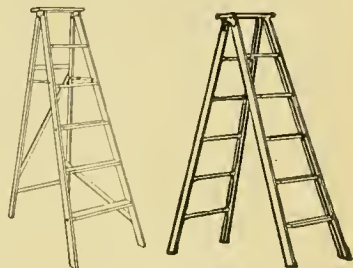
It seems to be a prevailing opinion regarding pruning-saws that the "Duplex" or double-edged saw should not be allowed in the commercial orchard. Even the most careful pruners will frequently gash the wrong limb with the back of the saw. The saw that comes nearest to filling all qualifications for pruning must be rather wide near the handle to give rigidity, and taper to a narrow point to allow close work between branches. The teeth should be of only moderate size but should have a wide set. Some prefer the swivel-saws but it requires practice to make a straight cut with them. The tapering swivel is of little use as the back makes it difficult to cut through a large limb. The California draw-cut type has many advocates and will cut rapidly, but it is adapted for small trees rather than general orchard use.

Harvesting implements.

Harvesting implements naturally group themselves under two classes,—those used in picking and those used in packing.

First among the picking implements comes the ladder. One of the early types of ladders consisted of a pole about 4 inches in diameter split at the base and spread apart, and provided with short cross-arms or pins at 12- or 14-inch intervals from the bottom to the top. This ladder, which is still used in some regions, is not well adapted for orchard service by reason of the side arms catching in the branches and interfering with ease in handling. Of the ordinary ladders, the type which is drawn together to a point at the top is far superior to all the others. The pointed apex is easy to insert into a tree and will rest securely and safely in

the crotch of a small limb, when a wide ladder would press inward and split off the limb. The base of the ladder should be well sprung to give stability when resting against a tree. The maximum limit of length which is practicable to secure in ladders of this type is 26 or 28 feet and even these lengths are cumbersome and difficult to handle. A modification of the ordinary painters' extension ladder with a pointed apex is probably the most convenient to use in picking the tops of trees 30 feet or more in height. One should pick such a tree once for the experience and then make a vigorous application of the pruning-saw some feet below the top.



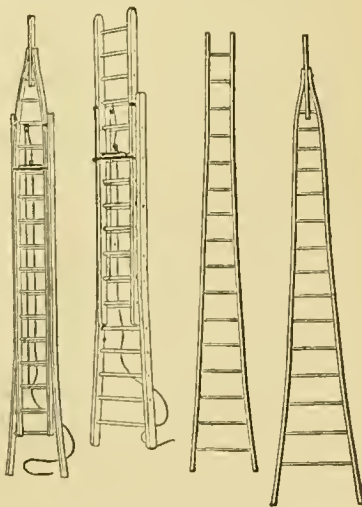
2280. Four-legged ladders, for use on level land.

For the picking of fruits from small trees, some type of step-ladder is used. The best kind for the commercial orchard is the tripod type in which the brace or support consists of a single leg. This will rest firmly upon uneven ground where it would be next to impossible to place a four-legged ladder securely. There are several forms of these ladders; those shown in Fig. 2279 are probably the most serviceable kinds. These ladders may be used as long as 10 or 12 feet, but 8 feet makes a more comfortable and practical length, particularly if the ground is slightly uneven. Some ladders are provided with an adjustable iron base for side-hill use or for service upon very uneven ground, which work fairly well but are rather heavy to carry, and the iron base sinks into the soil too much. Some peach-growers use a modification of the step-ladder in the form of a low platform on light legs. The four-legged ladders are shown in Fig. 2280; and forms of tree-ladders and extension-ladders in Fig. 2281.

The ladders described above are the ones mostly used by the experienced orchardist. For the orchard of the amateur and home grower, many elaborate or modified forms are offered, but while these are interesting they give way to simple pattern when the grower learns how.

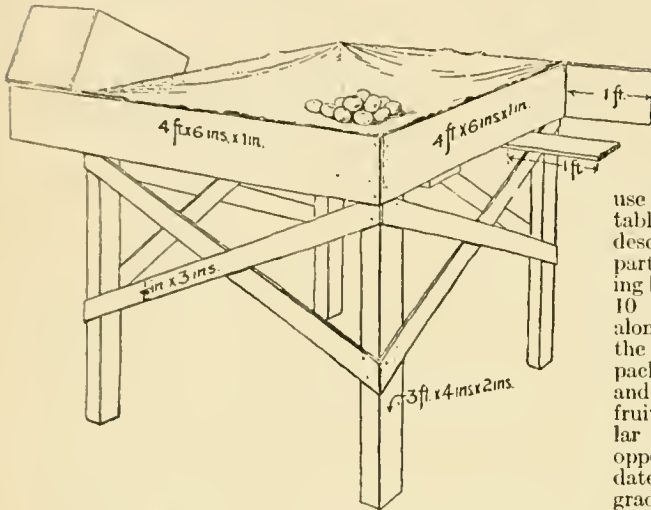
Another device that often appeals to the novice is the mechanical picker. Here many designs and styles may be offered, most of them consisting of a long pole with a cup at the end. The pole offers little opportunity for elaboration but in the form of cup, method of attachment, form of hook for dislodging fruit and other details, inventive genius has enjoyed an unrestricted field. Ingenious though these devices may be, their field of usefulness is extremely limited.

For picking apples, pears and peaches, the round, smooth-stave, swing-handle, half-bushel basket is probably the most



2281. Tree-ladders. At the left are two forms of extension-ladders

practical and widely used receptacle. The fruit will not bruise when placed in this, and the swinging handle enables one to let it down inside a barrel and empty the fruits without dropping them from a distance. Wire or rough-woven baskets cause unnecessary bruising because of their sharp and uneven surfaces. Many persons use a galvanized pail which discourages carelessness in dropping apples into the receptacle, as the noise can be heard for some distance.



2282. A good packing-table for box fruit, with canvas bottom and racks at two diagonal corners for holding boxes. (C. S. Wilson.)

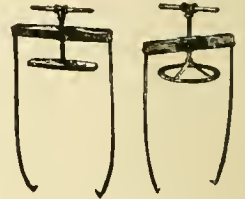
Picking-bags are made in a variety of forms from the simple grain-bag hung over one shoulder on a strap attached at the top and bottom, to the carefully made apron-like pouch hung in front of the picker by straps over each shoulder. When used carefully, the fruit will not be badly bruised in the bags, but the average workman with a small sense of responsibility will bump the bag against the ladder and in descending will often let it rest from round to round to ease the weight upon his shoulder. It often happens in such cases that 90 per cent of the fruit is more or less bruised before it reaches the packing-tables.

In the packing of all kinds of fruit, very much depends upon the use of a good packing-table. If this table is not properly constructed, the speed and efficiency of the sorting-crew will be cut down and a poorly packed box or barrel will often result. The orchardists have realized this and are now using over practically the whole country the same type of table which by experience they have found superior to all others.

For the packing of apples or pears in barrels, the tilted, slat-bottomed table is almost universally used. The body of the table is from $3\frac{1}{2}$ to 4 feet wide and from 6 to 10 feet in length. The sides and ends are of inch material 8 inches wide and the bottom is covered with slats 1 inch square running lengthwise of the table and spaced 1 inch apart. The legs are of 2 by 4 or slightly smaller material, 39 inches long at the lower end and 45 to 18 inches at the upper end. This allows sufficient height to place a barrel under the lower end and gives it enough pitch to keep the apples rolling down toward the lower end where the table is narrowed by a diagonal board to a funnel-like opening about 10 inches wide through which the fruit rolls to an apron over the top of the barrel. As the slack of the apron is filled, the packer lowers it carefully into the barrel, having meanwhile stopped the stream of apples by a gate, or with his hand.

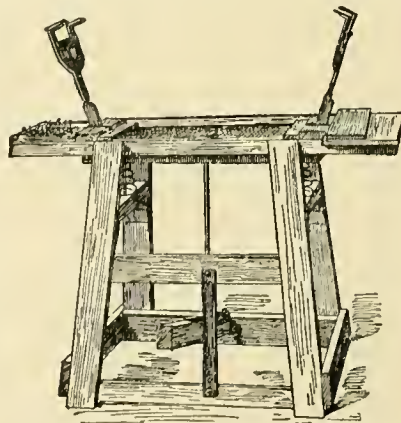
The box-packers have practically standardized the type of table suited to their needs. The body is in the form of a square 4 feet on a side and covered by a canvas top which sags slightly and forms a receptacle to hold the fruit. The legs are 3 feet in length and should be of 2 by 4 material well braced. From opposite diagonal corners the sides and bottom pieces extend 12 inches to form a rest for the boxes. This table, illustrated in Fig. 2282, is often made much longer and the top divided into several compartments similar to the one described so that it would be adapted to use in a large packing-house. The fruit is first graded and each grade placed in a separate section so that the packer works with only one grade at a time.

The peach industry has not developed its type of packing-table to a form as standardized as has the apple industry. There is, however, a style of peach-packing table in rather general use for putting up the six-basket Georgia carrier. This table is somewhat like the long box packing-table described in the last paragraph, except that the compartments are 3 feet square and instead of the projecting box supports, a long shelf 10 inches wide is attached along the side 10 inches below the top. Upon this shelf the packers rest their carriers and reach over them for the fruit upon the table. A similar shelf is built on the opposite side to accommodate the baskets of the graders as they sort the fruit into several grades. Over the packing-table at a convenient height is usually suspended another shelf to hold extra dividers, baskets, and other materials.



2283. Two simple screw barrel presses.

Several types of box-presses are upon the market, but equally good ones may be built at home. The one illustrated in Fig. 2284 is a common type and is not difficult to construct. The iron clamps which may be easily made by a blacksmith are attached by pins and should be adjustable to accommodate boxes of different heights. Barrel-presses are of two kinds, lever and screw. They are equally good, the choice between the two being one of personal preference. The lever presses are a little more rapid and are also more tiring upon the operator. A narrow iron circle is preferable to the customary bar across the top, but this circle must not be large and unwieldy or it will interfere seriously with



2284. A press for box fruit. The clamps, worked by a foot-lever, press down the cover until it can be nailed.

the operator's movements in placing the head. The simpler the construction of the press, the better. Two common types of screw presses are illustrated in Fig. 2283.

The mechanical grader is one of the most recent and probably the most significant developments in packing implements. The popularity of these machines is a clear indi-

eration of the spread of the movement for better packing throughout the country. It is impossible here to discuss the details of the various types of this machine (see *Packing*, Vol. V). In general they are so arranged that the fruit is carried over graduated holes, beginning with the smaller and ending with the largest sizes. In some cases these holes are in the form of a screen, in some a gradually widening groove or channel answers the purpose, while in still others ingeniously arranged spiral rollers or fingers force the fruit from one cup or hole to another until it is finally deposited in its proper receptacle. These machines are just emerging from the experimental stage and will doubtless be greatly improved in the near future, but it is worth noting that they are already giving good satisfaction. It is a safe prediction that in a few years they will be found in practically every up-to-date orchard of 10 acres or more in extent.

W. H. ALDERMAN.

Machines and implements in vegetable-gardening.

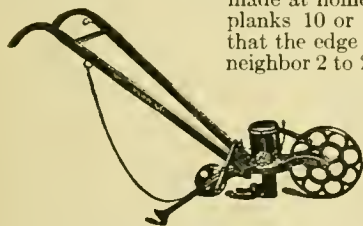
The invention and perfection of tools specially adapted to particular uses and to the needs of different crops has had a profound influence on the extent of cultivation and the profits possible from vegetable-garden products. The character of the tool and implement equipment for market-garden and truck-farming purposes necessarily varies with the extent of the industry, the character of the soil, and the climatic conditions under which the work is conducted. The implements required by the gardener and truck-farmer may be grouped in the following way: First, soil-stirring implements such as those used in the preparation of the soil,—plows, harrows, levelers, clod-crushers, and so on.

Plows.—The ordinary moldboard plow is the best soil-stirring implement for use on restricted areas large enough to permit the use of horse-power. When the operations are of sufficient extent, the mounted plow which permits of working from one side of the land, instead of plowing around or back-furrowing, will be found to have decided advantages for garden use as it permits the preparation of a strip of land without making back-furrows or dead furrows.

Harrows.—To accomplish the various needs of soil-preparation, spring-tooth, spike-tooth, and disc-harrows should be available, and of the latter type there should be not only the ordinary disc- or cutaway-harrow but also several other types, some of which are shown in Figs. 2263–2265.

Levelers (Fig. 2268).—One of the most efficient levelers and clod-crushers is the planker, which can

be made at home by placing three planks 10 or 12 inches wide so that the edge of one overlaps its neighbor 2 to 2½ inches and the three are firmly held together by bolting them to strong cross-pieces placed about one-fourth the length of the planks from either end. In



2285. A hand seed-sower.

irrigated sections, a different type of leveler is essential, but this need not be considered in the equipment for gardens located in humid areas. In gardens of good size a roller will also be found of decided advantage.

The second class of soil-stirring implements comprises those used for crop-culture. Those that can not be dispensed with are the five-tooth cultivator, equipped with teeth differing in shape and size to meet the requirements of the various crops. The spike-tooth harrow (Fig. 2261), which has a similar frame but has numerous slender teeth in place of the blades of the

one above mentioned, is another almost indispensable implement. Beside these horse-drawn implements, special tools, such as seed-drills for particular crops to be operated either by hand (Fig. 2285) or horse-power, will be needed. A battery of seed-drills is sometimes devised, for sowing several rows at a time. These are similar to fertilizer-distributors, which permit the operator to broadcast the fertilizer over the whole width of the row or to scatter it as a side-dressing near the base of the plants in adjacent rows. The implements needed for hilling, cultivating, or digging particular crops are to be determined by the character and extent of the crops grown.

Hand implements for cultural purposes.—Implements for hand work are quite as essential as the more expensive and more effective horse-drawn inventions and no garden can be successfully cultivated without a variety of hand-hoes, such as broad, pointed, and scuffle-hoes as well as an equipment of wheel-hoes with adequate attachments for performing the various operations necessary to the successful culture of small garden plants. Besides these, hand-weeders, dibbles, and trowels cannot be dispensed with.

Among the special soil-stirring implements worthy of consideration are the following:

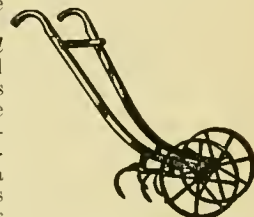
The Meeker disc-harrow.—The successful germination of small seeds depends more upon the preparation of the soil than any other single factor. The market-gardener has a number of small-seeded plants to handle and the quick and adequate preparation of the soil is an important matter. Before the Meeker disc-harrow came into use, the work of preparing a seed-bed for small seeds had to be done by hand. By the use of this implement, the final preparation of the seed-bed can be accomplished by the use of horse-power in as satisfactory a manner, in much less time and at less cost, as it can be done by hand. This implement fines, levels, and compacts the surface soil. In fact, it does the work of the steel-tooth garden-rake in an extensive way.

The wheel-hoe, shown in Fig. 2286, of which there are many modifications, has played an important part in the evolution of modern truck- and market-garden industries. In the hands of a skilled operator, it can be made to perform a major portion of the operations possible with the hand-hoe or broad hoe and the amount of execution possible is multiplied many fold.

The scuffle-hoe, which is a very slight modification of the ordinary hand-hoe or broad hoe, as shown in Fig. 2287, has not only minimized the effort needed to accomplish certain results but has at the same time placed at the disposal of the skilful operator a more effective implement. The combination of these two factors, conservation of effort and increased efficiency, should mean lessened cost in the operation to which the tool is adapted.

Next to the soil-stirring implements, those which distribute the seed either in drills or hills, as the special crop may require, and those which distribute fertilizers to stimulate the growth of such crops, bear a very intimate relation to the success of any horticultural enterprise.

The perfection of reliable row- and hill-dropping drills for sowing extensive garden areas has greatly reduced the cost of producing many crops. The combination of seed-sowers by the use of special carriages, which are used in sowing spinach and kale on four- or five-row beds, or for planting large areas of hoe-crops such as beets, carrots, onions, radishes, or even cabbage, has greatly augmented the uses of the seed-sower and reduced the cost of seed-sowing.



2286. The hand wheel-hoe.

The adaptation of fertilizer-distributing devices to the seed-drill still further reduces the labor-cost involved in the production of those crops requiring or permitting the distribution of fertilizers with the seed. Such inventions make it possible to substitute brute-force for man-power to a marked degree, thus increasing the efficiency and productive capacity of the man.

Another but somewhat more complicated device which lends itself in a number of labor-saving ways to the work of the market-gardener and truck-farmer, is the McWhorter fertilizer-distributor. This device is built for hand- and horse-power. It is so adaptable as to be readily adjusted for sowing fertilizers broadcast, or in drills, or as side-dressing to plants in rows. Truck-growers have long ago learned that in order to secure best results, fertilizers should be applied at particular periods in the life of the plant as well as in definite quantities in a special way. This implement meets these several needs more completely than any other fertilizer-distributor yet devised.

One of the minor implements worthy of mention in this connection is the celery-hiller. In those sections

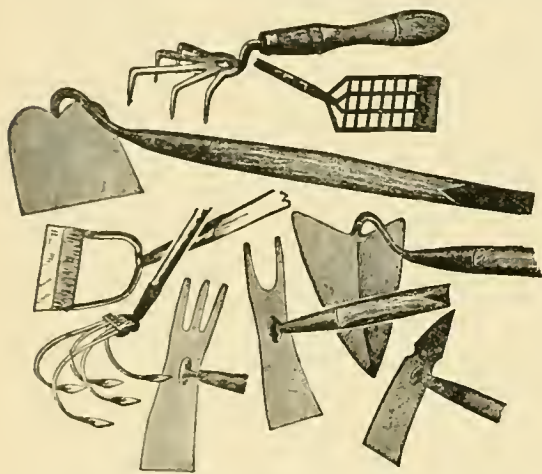
fact, in some cases a tractor has supplanted the battery of seed-drills.

Some of the implements that have had an epoch-marking influence on the crops, the special problems of which they were designed to meet are:

Transplanter.—The degree of perfection which has been attained in the modern transplanting devices has practically taken all the "backache" out of the extensive culture of all transplanted crops which are grown far enough apart to permit the use of a slow team to propel the planter. Such crops as cabbage, cauliflower, sweet potatoes, tobacco, and strawberries lend themselves to planting by this type of implement. Such crops as onions and celery, which are also transplanted, cannot be successfully handled with the models now on the market. The reason for this is due to the close planting distances required by such crops. It is not the proximity of the rows but the distance between the plants in the row that prevents the success of the machines now available. Preliminary tests that have been conducted with motor-driven implements of this character indicate that the solution of the problem lies in this field, for motor-driven devices can be geared to travel at any desired speed, but draft animals, while sometimes exasperatingly slow, cannot be trained to go slow enough to permit operators to set plants as close as 4 to 6 inches apart in the row.

The potato-planter.—The invention and perfection of this device has removed the operation of potato-planting from the domain of erew labor when potatoes are grown on an extensive acreage, to the domain of extraordinary extensive field-planting operations. It has reduced the man-labor requirements at potato-planting season so that a very slight increase in labor is capable of accomplishing what on a hand basis would be almost impossible in many sections where potato-growing now thrives. There are two general types of potato-planters which, for convenience, may be designated the "one-man" and the "two-man" types. Each of these machines has special advantages. The one-man type is less expensive to operate than the two-man type, but since the operator must depend upon the precision of a mechanical device unaided by personal supervision to secure the distribution of the seed, and since vacancies in the field tend rapidly to reduce the yield of the crop without reducing the cost of cultivation, the grower should consider carefully whether or not saving the labor of an extra man at planting-time is really a gain or a loss at harvest-time. The one-man type of machine, which uses pickers that puncture the seed-pieces, is liable to be an important factor in spreading certain types of tuber diseases. If such machines are employed, extreme caution should be exercised to eliminate from the seed-stock all tubers carrying diseases capable of communication from seed-piece to seed-piece by means of the metal pickers. The two-man machine costs more to operate, as it requires two instead of one man. If the seed has been carefully cut and the feeder attends to his job, this machine should give a perfect distribution and a corresponding stand. These devices are provided with another time- and labor-saving feature in the form of a fertilizer-distributing device. These attachments are so arranged as to place the fertilizer in the row, either deeper than the seed-piece or to scatter it into the drill in which the seed-piece is dropped.

The potato-digger.—Of the special implements designed to increase the efficiency of horse- and man-power expended in handling the potato crop, none has proved more of a boon to the grower than the potato-digger. It has made it possible to accomplish by means of horse-power in a given time what it would take several men to perform; to harvest large acreages at low cost in an incredibly short time; factors of great economic advantage considered from the point of cost



2287. Various forms of hand-hoes. The common square or broad hoe runs through the cut. Above it is a weeder and one form of scuffle-hoe. Below at left is a common kind of scuffle-hoe; and below it is a hand-cultivator. Other special hoes are shown.

in which autumn celery is extensively produced for storage, the crop is partially blanched before it is stored. Until recently this blanching was chiefly accomplished by hanking the plants with earth. When done by hand, this is a long, tedious and labor-consuming task, but with the aid of the celery-hiller operated by horse-power, human effort has been largely replaced and the cost of the operation has been correspondingly reduced. The onion-topper is another device which, like the celery-hiller, has reduced the amount of irksome and expensive labor in handling a crop.

It often happens that a recombination of elements results in a device of special merit in accomplishing important results. A combination of seed-drills is an achievement of this character which has solved an important problem in connection with the planting of spinach on raised beds. The climatic conditions, the texture of the soil, and the drainage requirements of the spinach plant have made it necessary that the crop be grown on four- to six-row raised beds. After these have been prepared, the tramping of operators to sow the seed with ordinary hand seed-drills would be objectionable, the work would be difficult and expensive. The battery of drills operated by horse-power has solved the problem for spinach as well as for planting sugar-beets and the sowing of onion seed for sets. In

as well as from that of safely gathering and storing the crop. It often happens in the northern potato-growing areas that the interval between the first killing frost, which is the signal for all hands to begin digging, and the time when actual freezing temperatures occur, is very short. It is therefore imperative that the facilities for digging and storing the crop be capable of accomplishing large tasks in short periods of time. The large, strongly built diggers upon which six horses are sometime used are implements of this type.

The pea-viner.—The invention of the pea-viner promoted the culture of garden peas from a minor place in the market-garden and on the truck-farm to the position of an acreage crop to be harvested with machinery and carried to the cannery. It made peacanning a factory enterprise instead of a side line to market-gardening and truck-farming.

Implements and devices which assist the grower in the production or preparation of his crop for market are of great economic importance, although often simple in design and relatively inexpensive. Such tools are well illustrated by the better types of hand-weeders, dibbles, and transplanting trowels. The asparagus-buncher, is a simple and inexpensive device which enables the asparagus-grower to accomplish two important ends—offering his product in uniform standardized bunches and of such length as the trade demands. Some markets and special trades require stalks of extra length. By the use of the buncher, a standard once established can be uniformly maintained.

While this by no means exhausts the list of special implements used in the production and preparation of vegetable crops for the market, it serves to point out the place which some of these implements and tools hold in the commercial production of these crops, as well as suggesting in a general way the fundamental equipment of a place devoted to the production of vegetable crops.

L. C. CORBETT.

Brief lists of implements for greenhouse and grounds.

The purpose in using tools for working the soil, either in the greenhouse, garden, lawn or on the farm, is to secure efficiency and also to save time and labor. Soil-working tools for greenhouse use are few and very practical. In many cases, the operator requires specially constructed tools for the work. The necessity for tools is also modified by the way in which the plants are grown and trained. In an article of this kind, the principles of operation of the endless list of greenhouse and lawn tools cannot be discussed; but a list can be suggested of the kinds of mechanical helps that the gardener most needs.

Many simple methods have been introduced to eliminate crowding and irregular growing in commercial and also in private houses, where bench-growing is conducted to any extent. There have come into use, within recent years, wires stretched horizontally over beds of roses and carnations, to which the vertical wires are fastened by clips. The method is good, as it looks neat and prevents irregular growth of the plants and admits use of proper tools for cultivating. For this tillage, the Eureka weeder, with short and long handles, is about the best, being made of flexible steel with narrow teeth, thus preventing seriously disturbing the roots when used for cultivating and weeding. The method of running the horizontal wires from end to end of the staging is by fastening them to a cross-bar of $\frac{3}{4}$ -inch-diameter galvanized pipe, so constructed and braced as to form an anchor at the elevation that accommodates the height of the plants. Wire pot-hangers are convenient for overcrowded spaces; also for such plants that do best by being suspended and given abundant light and air. These supports may themselves be classed with greenhouse devices and implements, and they determine to a considerable

extent the character of the hand tools that may be used on the bed or bench.

The watering-can is perhaps the most important requisite in the greenhouse or conservatory, but for the commercial house the hose is used entirely for watering and spraying. The long-spout can, fitted with brass tubing for attaching the rose or sprinkler, is the best. The special low can of four-quart size is used for watering seed-pans and boxes which are often placed at an elevation above the benches. The number of forms of watering-pots now available is considerable and represents excellent adaptation of means to ends.

Fumigators are necessary devices against insects. The combined fumigator and vaporizer acts in a double capacity, generates tobacco vapor as well as smoke, and prevents burning, which is often caused by the dry smoke. The fumigating lamp is used for vaporizing nicotine extract. Any apparatus of a lamp type will accomplish this work successfully. The brass syringe with its varied-sized caps, coarse and fine, for spraying or syringing and sold for watering seed-pans and boxes, is still in general use. Pressure sprayers are a greater convenience than the syringes and much more efficient for applying insecticides.

Among many important requisites for the greenhouse, the thermometer is an indispensable factor, as are also flower-pots, fern-pans, orchid-pans, orchid-baskets, seed-pans, and flats of wood used for seed-sowing and also transplanting seedlings, soil-sifting sieves for hand use, specially constructed wheel-barrow for greenhouse use, pot-washing machinery from the old style scrubbing-brush to the revolving brush machine of greater power and capacity which is used by the commercial florists.

In large commercial establishments, particularly for vegetable-growing, where the bench and staging are no longer used, the soil is handled the same as in the open, with either the spade-fork or plow, but in houses with side benches and large center staging, the soil is removed and replaced by hand carrying-boxes operated by two men, and in modern and extensive establishments by tilting cars running on a continuous cable. The very coarse soil is broken up and sifted through large riddles, 6 feet long and 3 feet wide and standing on an angle.

Tools for the lawn.

The finished lawn requires constant attention. It does not demand a great variety of tools, but they should be practical and efficient. Of the lawn-mowers, the most recent is the gasoline motor, which has the great advantage of doing the work of mowing and rolling in early spring without disfiguring the lawn, as is the case when using the horse lawn-mower. Steam- and gasoline-power lawn-mowers have been in use for several years, and have hitherto been very heavy and unwieldy; however, in the recently introduced machines, the weight is no greater than the horse-power 30- and 36-inch-cut mowers. The operator usually walks in the rear where he has full control in guiding the machine and regulating the power. In large park areas, private or public, the ordinary farm mowing-machine may be used; and in some places sheep may be employed to crop the grass, as on golf-courses. The old-fashioned grass scythe still has many uses about large lawns.

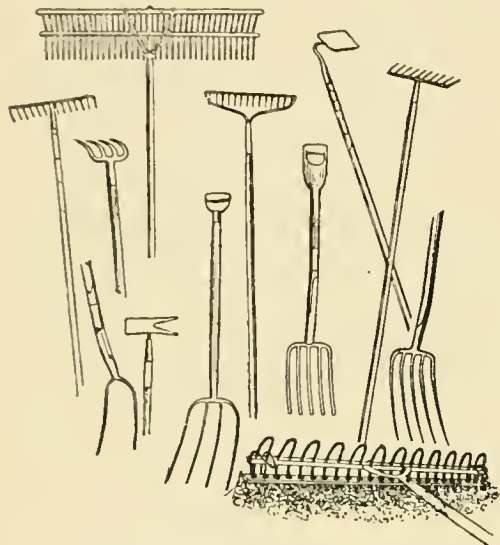
The lawn-sweeper for hand- and horse-power is a lawn accessory not in general use, but it does finished work, particularly in late summer and fall, when the fall and other coarse grasses make their appearance, and prevents their seeding for the following year's crop.

Hand lawn-mowers of low- and high-wheel makes are now used in all parts of the world where lawns are to be found. Without the hand lawn-mower, the tennis-court and the putting-greens of the golf-links could not be kept in proper condition for use. The cropping

of grass for appearance serves two purposes: it induces thick growth and insures an even surface.

The lawn-roller is the first lawn tool used with advent of spring. It closes the surface of the lawn which has been honeycombed by the frosts and freezing during the winter months, firms the soil and grass roots into close proximity, and also presses down the mole-runs. After sowing grass seed, whether in the already established lawn or in a new one, the rolling process is essential. Every horse- or other lawn-mower is equipped with a roller and can be used as a roller only.

Dock-extractors, dandelion-lifters, steel spuds and knives for cutting plants are all used for exterminating objectionable weeds, which infest lawns. Scythes and grass-hooks (sickles) are the grass-cutting tools to be used where the lawn-mower cannot be employed. Grass-shears and border-shears are essential for cutting



2288. Various commendable forms of lawn and garden rakes, forks and hoes.

grass along the edges of foot-paths, walks, flower-beds, and also along the edge of carriage-roads. Lawn-shears are used for cutting grass under fences and under trees that grow close to the ground. Grass-edging knives and narrow spades are also used for cutting along borders and beds in the spring to secure an even edge.

The leaf- and rubbish-cart, the leaf-rack of wire placed on a broad-tired wheelbarrow, make excellent vehicles of man-power to transport all kinds of rubbish, tree branches and leaves from the lawn to the deposit for such. Lawn-rakes for leaves, scarifying rakes for reseeding and removing moss surfaces in shaded portions of lawns are useful. Lawn-sprinklers are obtainable for the small grass-plot, and for large areas of almost indescribable patterns and capacity, stationary and revolving.

For even distribution of fertilizers and grass seeds, the use of the "velvet lawn seeder and fertilizer sower" is recommended. These machines are so constructed that they cut shallow grooves in the sod, sowing the seed directly into the openings to insure germination, also covering and rolling in the same operation. The fertilizer machine is arranged with a comb similar to a rake, thus scarifying the lawn before the distribution of dry fertilizer, as bone, sheep-manure, nitrate of soda, ashes, ground lime or plaster.

Tools for the garden.

Garden tools are in endless variety and there are special types for either light or heavy soils. The spade is still the best tool for the heavy soils, and the dig-

ging-fork for light soils; the hoe persists for all soils. The scuffle-hoe is standard for cultivating and weed-cutting; the Warren hoe for cultivating, furrowing and ridging; the common garden hoe in one, two and three prongs for cutting weeds and breaking the soil; the square and half-moon hoe are used principally for cutting weeds and leveling the surface (Fig. 2287). Steel garden rakes, narrow and wide (Fig. 2288), are necessary for leveling broken soil. Steel-bow rakes are useful for handling coarse cloddy soil.

Wheel-hoes, and cultivators with adjustable teeth for cultivating, discs for breaking clods, plows for ridging and furrowing, and also for opening the earth for planting and sowing, are the most practical garden tools, being great labor-savers. When properly and frequently used, they will keep a garden neat and clean. Seed-drills are not practicable for a small garden, but for the market-garden they are most important, both for uniformity and economy in sowing the seed, obviating thinning by hand. The hand-thinning is an expensive operation, wasting the plants that are pulled out, and injuring what are left. The modern seed-drill is so constructed that it will drop seed at intervals as well as distribute them in a continuous line. This form is known as the hill-dropping drill. Some drills are equipped with interchangeable cultivating tools. The market-gardener does not consider this feature practicable, and therefore prefers separate drills and cultivators; but for hotel and private gardens the combined tool is used.

All vegetable seeds, except lima beans, can be sown with seed-drills; they open the furrow, sow the seed, cover, press it down and make the mark for the next row to be sown, all in one operation. The first row being marked out with garden-line, the marking-iron is set at the required distance. The double wheel-hoe and cultivator is the market-gardener's favorite, as it can straddle the row and cut from each side, thus throwing to center of row. The operator then rakes out the center, following between the rows with teeth attached to the hoe to break the soil. The hand-plow is a favorite tool for the private garden. It can be set at different depths.

The wheelbarrow-drill in 14- and 16-foot lengths is the most uniform distributor of grass seeds. Over large areas, it is arranged with an agitator inside to force the seed through the openings. The lawn-seeder is equipped with discs which cut shallow openings into which the seed drops. Fertilizer-drills are used, as already indicated, for the field, garden and lawn, and distribute evenly and in the required quantity.

J. OTTO THILOW.

Spraying machinery and tools (see also pp. 1057-1060).

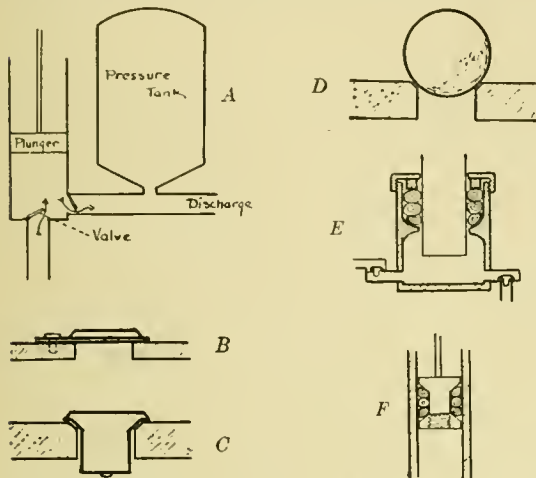
In recent years, the appliances and devices for the application of sprays to destroy insects and fungi have become numerous and much specialized. As the pests to be met are many and very different, so is the machinery of the most diverse patterns. Certain standard practices, however, have developed a line of implements that meets perhaps four-fifths of the needs, and some of these constructions may be briefly considered here. Spraying is now one of the established practices in the growing of plants.

Pumps.

The spray-pump is the ordinary lift-pump found in most wells to which has been added a means of regulating the discharge, thus changing the lift-pump to a force-pump. If a tight-fitting plunger moves up in a cylinder, it pushes in front of it a certain amount of air and an equal amount rushes in behind the plunger to fill the space. If the lower end of the cylinder is placed in water, as the plunger moves upward air is still driven out at the top but, since none can now enter at the bottom, there is a tendency to create a vacuum

and the atmospheric pressure outside the cylinder forces the water up toward the plunger.

One may swing a door open in one direction but it closes tightly against the jamb in the other direction. If a similar arrangement, called a valve, is put at the bottom of the cylinder, water can then enter but can



2289. A, diagram of a simple pump; B, the clapper valve; C, the poppet valve; D, the ball valve; E, an outside-packed pump; F, an inside-packed pump.

not run back and the water which enters the cylinder is thus held. If a discharge-pipe is now placed at the lower end of the cylinder, as shown in Fig. 2289, A, and a valve placed in this which swings so that water can flow out, but not into the cylinder, our simple pump will be completed. On the upward stroke of the plunger one valve opens and the other closes; on the downward stroke this action is reversed and the water is driven out the discharge-pipe.

The water from such a pump would come in spurts with each stroke of the plunger. If an opening is made in the bottom of an air-tight chamber, or tank, and this connected with the discharge-pipe, we have a means of preventing these spurts and maintaining a steady pressure at the discharge. When the piston moves downward and water is sent into the discharge-pipe, some of it is forced up into this air-chamber, compressing the air as it enters. When the plunger starts backward, this compressed air can then expand and force out the water. Thus, part of the time, water is leaving the discharge directly from the push of the plunger and part of the time from the expansion of the air in the pressure-tank.

There are three general types of valves: (1) *The clapper valve* consists of a flat plate covering the valve opening and hinged on one edge so as to swing in the manner of a door (Fig. 2289, B). Frequently the face of the plate is covered with rubber or leather. Except in a few of the cheaper hand-pumps, this valve is not found in modern spray-pumps. (2) *The poppet valve* is one of the most widely used forms, especially on the cheaper pumps. It consists of a flat plate with a tongue projecting at right angles and acting as a guide to hold the plate in place over the valve-opening (Figs. 2289, C, and 2290). A flake of rust or a particle of the spray mixture is liable to catch under the plate and prevent the valve from closing tightly. (3) *The ball valve* has a metal ball resting on the round opening (Fig. 2289, D). The upward movement of the liquid raises the ball but downward pressure only holds it more firmly in place. Usually a cage is constructed over the ball to prevent it from falling out of place. This type has generally proved the most satisfactory. The constant shifting

of the ball tends to grind the valve-seat smooth and prevent any foreign particles from holding up the valve off the seat.

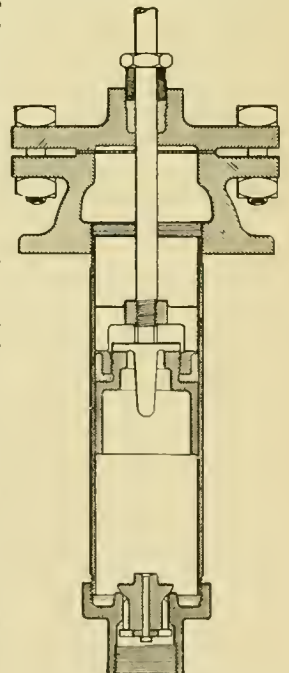
The air imprisoned in the pressure-tank acts as a spring to equalize the discharge. If the spray pulsates, it shows that the tank is too small or that it has become filled with water instead of air. Hand-pumps with a relatively long time between strokes of the plunger require a larger pressure-tank than do power-pumps, especially those having two and three cylinders. Most tanks are cast-iron and are very heavy; also, with cast-iron, there is always danger that a thin place will give way under pressure and cause serious trouble. Sheet-steel tanks are lighter and better. All power-pumps and many hand-pumps are supplied with a pressure-gauge. This is usually attached to the pressure-tank.

It is essential that a relief-valve be supplied since most power-pumps can easily be made to develop a pressure too high for the pressure-tank and hose to stand with safety. These valves are so constructed that they may be set to act at any desired pressure. The usual type is a ball or poppet valve held in place by a powerful spring whose tension can be regulated by a set-screw. When the pressure of the liquid on the valve becomes greater than the push of the spring, the valve is raised and the liquid then passes back through a pipe to the spray-tank. Such valves frequently cause trouble by the uneven wearing of the valve or valve-seat and the corrosion of the spring and working parts.

A few pumps are now supplied with relief-valves so arranged that when the valve is raised the pressure-tank and discharge are cut off from the pump, and the liquid leaving the pump flows freely back into the spray-tank. This causes no wear on the relief-valve and, since the pump does not have to work against pressure while the valve is in action, it leads to a considerable saving in power.

If valves held without loss, and no material leaked past the plunger-packing, the discharge of the pump would be equal to the area of the piston-head multiplied by the length of the stroke. Valves always leak back to a greater or less extent and the packing is seldom entirely tight, so that the actual and theoretical discharge are not the same. The difference between the two is called the "slippage." This will sometimes run as high as 50 per cent when the valves are not fitting tightly.

In using a hand-pump, it is less tiring to make a few strokes against heavy resistance than to make many strokes against a lighter resistance. For this reason pumps designed for hand use should have relatively large capacity. On the other hand, large capacity should not be obtained by increasing the diameter of the plunger beyond a certain point. A 2-inch plunger when working against 100 pounds pressure requires over 300 pounds of energy and even with the well-planned leverage of the long pump-handle this is about the maximum which may be demanded of the man on the handle.



2290. Section of single-action pump-cylinder showing poppet valves and inside packing.

In most pumps there is a narrow space left between the piston and the inner wall of the chamber. This is filled with some one of the many kinds of packing. One of the cheapest of these is made of loosely rolled tow strings and is sold as "candle-wicking." The best kinds are combinations of canvas and rubber. It is poor economy to buy cheap packing. The best does not last very long and the time lost in replacing poor packing would pay the slight extra cost of the better grades many times over.

No other part of the pump requires as frequent attention as the packing, therefore it is important that pumps should be so designed as to give ready access to the packing and also that some means should be provided for keeping it tight against the plunger.

Considering the packing only, pumps may be divided into two classes: outside-packed and inside-packed. An outside-packed pump is one in which the packing

and at the same time draws in liquid back of it, then, as the plunger moves back, this second amount of liquid is pushed out and a new charge drawn in behind the plunger. Thus, a complete forward and backward movement of the plunger should discharge twice the capacity of the cylinder. Such a pump requires four valves and always has the packing on the face of the plunger.

Nozzles.

Spray liquids were first applied in a solid stream, though this was usually fine enough to be broken into drops by the resistance of the air. The next step forward was to place an obstruction at the end of the nozzle so that the stream, striking against this, was spattered out in fine drops. This method is still in use in the bordeaux nozzle, a device that gives a fan-shaped spray which at high pressures—two hundred pounds or more—is mist-like. It is not adapted to fungicides, but may be used in applying poison sprays.

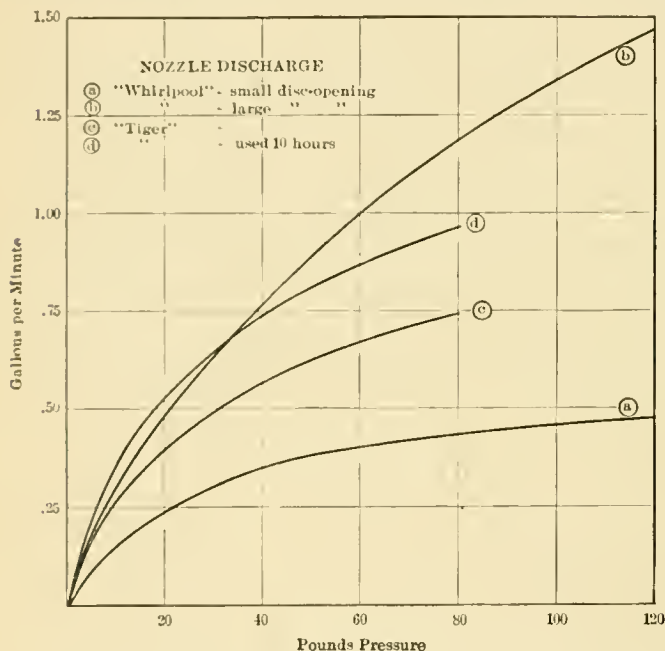
In eddy-chamber nozzles, the liquid is thrown into a whirling, or cyclonic, motion in an eddy-chamber from which it is discharged through a small opening. Particles leave this opening in a direction tangent to their previous rotation, thus producing a cone of spray more or less uniformly filled. There are two ways in which the rotating motion is secured in the eddy-chamber: in one, the liquid enters the chamber through openings which have much the same pitch as the thread of a screw; in the other, the liquid enters through a passage tangent to the outer edge of the eddy-chamber. The screw-thread nozzles are usually straight nozzles, that is, the lines of entrance and exit are in the same direction, and are best adapted to use in the orchard. The tangent-entry nozzles are usually at right angles to the hose or spray-rod. Some of them are well adapted to field-spraying.

At low pressures the quantity of liquid discharged by a nozzle increases rapidly with increases of pressure, but at higher pressures the increase in discharge grows less as the pressure increases (see Fig. 2291). As the pressure increases, the size of the spray particles decreases.

The front face of all eddy-chambers is made by a thin disc in the center of which there is a round hole, called the discharge-disc opening. The smaller this opening, the finer are the particles of spray and also the smaller the volume discharged in any given time. A change from a small to a large opening may double or triple the discharge. The wear of a week of spraying may so enlarge the discharge-opening as to increase the discharge from 50 to 100 per cent.

With hand-pumps it is usually desirable to use the lowest pressure which will give a good spray; therefore, with such pumps, the nozzle-discs should frequently be renewed and only those with small openings used. The discs cost but a few cents. Even with the same size of disc-opening, different makes of nozzles give a satisfactory mist-spray at various minimum pressures, ranging from as low as thirty to as high as one hundred pounds; therefore a knowledge of the minimum pressure at which a nozzle may be used is desirable when one is using a hand-pump where the pressure may, at times, run low.

Sufficient emphasis has not been laid upon the importance of securing the nozzle best adapted to each purpose. From what has been said above, it is readily seen that no small part of the success of the spraying, especially when hand-pumps are used, depends upon



2291. Diagram of the pressure and nozzle discharge. The amount of spray discharged increases rapidly at low pressures but more slowly at higher pressures. The amounts differ with different makes.

is set on the inside of the pump-cylinder and presses against the outside of the plunger (Fig. 2289, *E*). Such packing may usually be reached without removing the plunger. An inside-packed pump is one in which the packing is on the face of the plunger and presses against the inside of the pump-cylinder (Figs. 2289, *F*, and 2290) thus necessitating the removal of the plunger before it can be renewed.

All parts, such as valves, plungers, and cylinder lining, which come in contact with spray materials, should be of brass, as this does not corrode so rapidly as steel. For inside-packed pumps, a bored cylinder is truer than a drawn tube and so pumps much easier because of the decreased friction.

A single-action pump is one which draws in the liquid as the plunger moves in one direction and drives it out as the plunger moves back. There are only two valves on such a pump. When two single-acting cylinders are used on the same pump it is called a two-cylinder, or duplex pump; one with three such cylinders is called a triplex pump.

A double-action pump is one in which the plunger, as it moves forward, pushes the liquid out ahead of it

this factor; also the cost for labor and for materials may be decreased largely by judicious selection of nozzles and discharge-disks. One may thus regulate the amount and fineness of the spray according to the size and character of the trees to be sprayed, the outfit used, and the speed of the men who direct the nozzles.

Spray-hose.

The ordinary spray-hose is made up of one to seven layers of canvas embedded in rubber. The five- and seven-ply are the best for use with power-pumps but the three-ply may be used with hand-pumps.

For spraying purposes, it is not advisable to use a hose of more than $\frac{1}{2}$ -inch diameter. The added weight of the larger sizes makes them too awkward to use. For the trailing hose on a power-rig one of $\frac{3}{8}$ -inch diameter is best, but for the hand-pump the $\frac{1}{2}$ -inch size should be used because the loss of power through friction is less in the larger size.

When one expects to use trailers, and this should always be the plan in the apple orchard, the trailing hose should be long enough so that the tower-man can spray one tree while the trailer is finishing another. Fifty feet is the usual length for the apple orchard.

The couplings are the parts to which the hose is attached and which screw into the spray-rod and to the discharge-pipe of the pump. Improperly constructed couplings may cause considerable annoyance by permitting the hose to pull off. The shank over which the hose slips should be long enough so that two hose-bands may be used to clamp the hose upon it. The holding power of the shank is increased if the surface is ridged.

Additional equipment for orchard-spraying.

With most of the spray-nozzles now in use, it is necessary to bring the nozzle within 3 or 4 feet of the branch to be sprayed, or at least to raise it as high as the branch and let the spray drift with the wind. The use of extension spray-rods is a great help in this. The rod usually consists of a bamboo cane with an iron or aluminum core. The iron core is stronger and cheaper but because of its greater weight it is not so desirable as the aluminum, especially for the longer rods. An 8-foot rod is usually long enough for peaches, pears, and low-headed apples, but in many of the older orchards in New York and New England the 10 and 12-foot rods must be used.

With most of the sprays and especially so with the first codlin-moth spray, it is desirable to drive the liquid down on the tree with one of the rods. To do this it is necessary that one man be placed in a tower which is built over the pump or water-tank. The height of the tower depends upon the height of the trees to be sprayed. Usually the tower floor is from 5 to 7 feet above the hubs. If a high tower is put on a light rig there is danger of tipping over on rough ground. Many towers are now built with an iron framework and some of these fold back upon the tank when not in use. See pages 1057-1060; also page 1295.

The orchard spray rig usually carries from 100 to 200 gallons of spray solution. Various types of tanks are used for this purpose. The usual one is a half-round tank with the rounded part resting on the trucks; round tanks standing on end, and metal tanks are also used. For temporary use in a cheap rig, two fifty-gallon oil-barrels can be used.

Most of the spray mixtures contain matter in suspension and so some means of agitating the liquid is necessary. A common method is to place two paddles so that they will swing back and forth just over the bottom of the tank and connect them by a rod to the handle of the spray-pump. In some power-sprayers a shaft is run through the tank and two propellers are placed at opposite ends, each driving the liquid toward the center.

Types of spray-rigs.

The use of the hand-pump is confined to the garden, to young trees and small orchards. It is possible to spray 4 or 5 acres of mature apple trees with a hand-rig and do the work well, provided an efficient pump is used, but with such rigs it is usually necessary to use one more man than with power-rigs and to go somewhat slower. If a careful estimate of the relative costs were made before the hand-pump is abandoned for the power-rig, many would still continue to use the slower method and, even when a power-pump is purchased, the hand-pump should be kept in good condition to use in emergencies and when the ground is too soft for the heavier outfit.

If only a few bushes are to be sprayed, one-quart syringes, costing less than a dollar, can be secured. These work on the principle of the atomizer. For the garden and a few trees, bucket-pumps are satisfactory and inexpensive though it usually requires two men to use one. Some very satisfactory one-man pumps are now manufactured on the same principle as that used in the pressure-tank of the larger pumps. An air-tight tank, holding several gallons, is half filled with the spray mixture and the remaining air is compressed by an air-pump till the desired pressure is obtained.

The barrel-pump is the commonest form of hand-pump. Its popularity is due to its being cheap, compact, sold ready to use, and having sufficient capacity for the small home-orchard. On the other hand, the up-and-down motion of the handle is very tiring and high pressures can not be maintained for any length of time.

Separate pumps, mounted on a low base and operated by the back-and-forth movement of a long, upright handle are much easier to use and will develop a very satisfactory pressure. Such a pump, either with two cylinders or double-acting, will run four low-pressure nozzles and, by using one or two barrels for the spray-tank, an efficient outfit can be provided at a reasonable cost.

The traction-pump may be driven by the rotation of the axle for field-spraying, for the vineyard, the bush-fruit plantation, or for young trees where it is possible to keep the rig moving most of the time, but it is not possible to secure sufficient power in this way to spray large trees. The greatest trouble with many of the rigs of this type which have been on the market has been that they were too complicated and, therefore, troublesome to use, and costly. The present tendency is to make rigs which are much simpler. Usually a good type of hand-pump is used and is connected to the axle by means of a pump-jack or gearing. It is necessary to have a large-size pressure-tank in order to keep a uniform spray.

When the traction-sprayer is used for field-crops and occasionally in the vineyard-spraying, the nozzles are attached to an adjustable spray-boom. When such a boom is used, care should be taken to see that the sprays from adjacent nozzles overlap before reaching the plants to be sprayed.

Gas-engine rigs are for the large commercial orchard. If the engine is to be used to run the spray-pump only, it does not need to be over two and one-half horse-power and many engines are in use which develop but a single horse-power. Some of the rigs which are planned to run saws and grinders have as high as three and one-half horse-power but this greatly increases the weight.

Simplicity of construction is one of the most desirable features, as it means less trouble in running and fewer parts to wear out. A certain degree of lightness is also desirable, provided it is not secured by a sacrifice of needed strength. Heavy, cast bases are entirely unnecessary as the desired stability can be secured by lighter angle-irons. Most power rigs have a water-cooled engine and the consensus of opinion seems to favor this type. There are, however, one or two excel-

lent air-cooled engines on the market that have given very satisfactory service. The demands that are put upon the engine are variable and for this reason a good governor is an important aid in maintaining a uniform pressure and avoiding engine-racing. It is probably for this reason—ease in governing speed—that the hit-and-miss spark is much more commonly used than the jump spark.

The lighter and cheaper rigs are frequently made by connecting an engine of about one horse-power with some one of the more efficient hand-pumps, but on most of the power outfits the pumps are especially designed for this use and are of large capacity. Because of the greater steadiness of the discharge-pressure, the more uniform amount of power required from the engine, and their greater capacity, the triplex pumps are more generally used than the duplex.

Pump and engine are connected in various ways: with some a belt or chain is used, others are connected by gears, while still others are directly connected by a shaft in which a universal joint is usually placed to avoid trouble should the alignment not be exact. It is always advisable to have them so arranged that the engine can easily be disconnected and used independently. It is quite important that pump and engine should be so placed and the pump so designed that all valves are readily accessible and also that the plunger-packing can be reached and replaced quickly.

Spray-tanks of three sizes are used, 100, 150, and 200 gallons. Two hundred gallons of water weigh over 1,600 pounds and when this is added to the weight of the rig it frequently becomes impossible to haul a loaded sprayer of this size over soft ground; on the other hand, if the water-supply is not readily available, too much time is spent in filling the smaller tanks. The larger number of the more expensive outfits with large-capacity pumps have the largest size of tank and when the ground is too wet only half a tankful is used.

In spraying orchards on steep hillsides, it sometimes is impossible to use the tower without tipping over the rig. To avoid this, some manufacturers put out sprayers with the tank hung low so as to bring the center of gravity down nearer to the axle of the truck.

A few rigs have been made in which the liquid is placed in an air-tight tank that is connected to a cylinder of compressed carbon dioxide gas, such as is used in all soda-water fountains. The expansion of the gas entering the liquid-chamber supplies the necessary pressure. These sprayers give satisfaction when used with bordeaux mixture but, when used with lime and sulfur to which has been added arsenate of lead, a chemical action takes place with the gas which releases soluble arsenic and thus causes serious burning on the foliage sprayed.

Some growers, whose orchards are on steep hillsides and where the land is too rough to take a sprayer of the usual weight, have had satisfactory results from the use of compressed air. Two metal tanks are mounted on a low two-wheeled truck. One of these is filled with the spray solution and, with a compressor which is mounted at the filling-platform, air is pumped into the second tank till a pressure of 300 to 400 pounds is reached. This pressure is then gradually turned into the liquid-tank as the solution is sprayed out. The greatest part of the cost is in the engine and compressor, but if these are used to run several sprayers the final cost is not high. There are some mechanical difficulties still to be overcome before these rigs are entirely satisfactory, yet they illustrate a method that has much to commend it.

Tools, repair parts and extras.

There are few operations on the farm in which the efficiency of the work depends as much upon the time at which it is performed as in spraying. This makes it essential that care be taken to prevent loss of time

through minor troubles. The value of time spent in hunting for a certain tool to tighten a connection may be sufficient to buy the tool many times over. The first requirement is a kit of tools consisting of hammer, two wrenches,—one a pipe-wrench,—screw-driver, cold-chisel, and pliers. A collection of nuts, bolts and washers and a few feet of fine and heavy wire should be added to this. A supply of durable packing sufficient to repack all the pump-cylinders should be on hand at all times. It is well to have a piece of rubber gasket-cloth from which washers and gaskets for unions and other connections can be cut. A supply of new nozzles, nozzle-washers and especially nozzle-discs is essential. The breaking of an extension-rod is of such frequent occurrence that it is desirable to have one in reserve for such emergencies. Wherever hose is used an extra length should be carried.

With a power rig, the ignition system is usually the cause of most of the trouble. Batteries need to be replaced at least once in a season and, with a jump spark, a new spark-plug is occasionally needed. It seems almost needless to say that a plentiful supply—and liberal use—of oil and cup-grease is necessary, yet many machines are injured by lack of this.

In using a traction-sprayer for different field-crops and especially if the same sprayer is used in the vineyard, it is frequently desirable to change the arrangement of the nozzles. With a hack-saw, file, ¼-inch pipe thread-cutters, a few feet of ¼-inch pipe and a few couplings, nipples, unions and elbows, this can quickly be done.

Mixing-platforms, boilers, filling devices.

In most cases where bordeaux mixture is used, it is made on the farm as it is needed. In such cases the work is simplified by the use of a mixing-platform with the floor high enough so that the liquid can be poured directly into the spray-tank when the rig is driven to the platform. There should be space for at least four barrels. Such a platform should be placed so that water is readily available. If there is no windmill or power-driven pump, the platform should be directly over a well with the pump mounted on the floor.

A similar platform is very convenient where lime-sulfur is to be made on the farm, using steam for the boiling. The boiler can be placed on the ground or in an adjacent building and the steam piped to each barrel. For this work any boiler may be used which can develop ten or fifteen pounds pressure.

When lime-sulfur is to be made by direct heat instead of steam, any standard feed-cooker or simply a large iron kettle can be used. When any considerable amount of liquid is to be boiled, it adds greatly to the convenience if water can be piped directly to the kettle and if the lime-sulfur can be emptied directly into barrels by a siphon or a discharge-pipe from the boiler.

It is not uncommon for it to take longer to drive from the orchard to the water-supply, fill the tank and return than it takes to spray out the tank. Efficiency in spraying necessitates a convenient water-supply. If the mixing-platform is near enough, it can be used as a reservoir from which a tank-load can quickly be secured. Some of the manufacturers are now equipping rigs with either an auxiliary filling-pump or a device working on the principle of the injector and taking the power from the spray-pump. These are very convenient where an elevated supply of water is not possible. Where a nearby water-supply can not be secured it is best to haul the water to the sprayer in tank-wagons or in barrels.

R. D. ANTHONY.

MACKĀYA: Asystasia.

MACLEÂNIA (after John Maclean, British merchant at Lima, Peru, patron of botany). *Eriocar.* About a dozen species of shrubs in the mountains from Mexico to Peru, useful for ornament under glass but little

known in cultivation. They have clusters of brick-red or crimson, tubular flowers each an inch or more long, and often bear tinted foliage.

Leaves evergreen, alternate, short-stalked, entire: corollas strongly 5-angled, and the 5 tips short, triangular, erect or spreading and more or less yellow; stamens 10, much shorter than the corolla; disk ring-like or not evident; ovary 5-6-celled, the style filiform; ovules many.—One species, *M. insignis*, is currently offered abroad. Macleanias are probably of difficult cult. *M. speciosissima* in a large pot on a shelf near the glass, so that its branches may hang gracefully, should be a very striking subject. *M. pulchra* has the same habit and color of fls., but is perhaps less desirable. *M. punctata* is perhaps the most desirable of those with erect branches and stiff habit. This may be tried in a warmhouse border, with good drainage and shallow soil, as some of these macleanias have thick fleshy roots and the fibrous parts of the roots are said to keep near the surface.

insignis, Mart. & Gal. Young foliage on spring growths with tints of red; a small evergreen shrub: lvs. 1-2 in. long, oblong or elliptic, obtuse or subacute, coriaceous: fls. axillary, scarlet, the cylindrical corolla 1½ in. long; calyx short, minutely 5-toothed; corolla-lobes small and spreading; filaments united to form a tube. Mex. B.M. 7694. G. 32:351; 36:517.—A handsome plant both in foliage and fl. for greenhouse. Said to have been first discovered growing epiphytically on oaks at an elevation of 4,000-6,000 ft. in Province of Vera Cruz.

A number of maeleanias mentioned in the literature do not appear to be regularly in the trade, as: *M. angulata*, Hook. Lvs. ovate, rather coriaceous, obtuse and entire, those on the young shoots delicate and with a deep tinge of red; fls. axillary, in 3's; corolla nearly 1 in. long, bright red with a yellow limb, contracted at the mouth, with 5 prominent angles or ridges. Peru. B.M. 3979. H.U. 4, p. 327.—*M. longiflora*, Lindl. Near *M. angulata*, but with longer and narrower lvs., and the fls. less contracted at the orifice and the lobes not yellow. B.R. 30:25. H.U. 6, p. 100.—*M. pulchra*, Hook. Branches long and drooping: lvs. rather large, glossy, elliptic or oblong, short-petioled, 5-nerved: fls. aggregated in the axils, large, about 1¼ in. long, the corolla-tube bright scarlet and the limb yellow. Colombia. B.M. 5465.—*M. punctata*, Hook. Lvs. somewhat secund, sessile or practically so, oval, obtuse and entire, glossy and dotted: fls. crowded in upper axils, on red clavate peduncles; corolla 1 in. long, swollen below, rose-red and the upper part white tinged with yellow. Andes. B.M. 4426. G.W. 12, p. 774.—*M. speciosissima*, Hook. Most beautiful plant in bloom: straggling shrub, with long pendent branches: lvs. distichous, 2 in. or more long, ovate or oblong-ovate, obtuse, entire: fls. many, drooping in terminal fascicles; corolla 1¼ in. long, bright scarlet, yellow above, contracted below the small limb. Colombia. B.M. 5453.

L. H. B.



2292. Osage orange fruit.—*Maclura pomifera*. (×½)

MACLÈYA: *Bocconia*.

MACLUDRÀNIA. *Moræacæ*. A bigeneric hybrid between *Maclura pomifera* var. *inermis* and *Cudrania tricuspidata*. (See Vol. II, p. 911.) *M. hybrida*, André, is a small tree with yellowish furrowed bark and short woody spines: lvs. alternate, glabrous, violet beneath, oval, long-acuminate.

MACLÛRA (after Win. Maclure, an American geologist). Syn. *Tózylon*. *Moræacæ*. OSAGE ORANGE. BOWWOOD. Tree chiefly grown as a hedge plant, also planted as an ornamental tree for its handsome bright green foliage and the conspicuous orange-like fruit.

Deciduous, with milky sap: branches with axillary

thorns: lvs. alternate, entire, slender-petioled, with minute stipules: fls. dioecious, minute, apetalous; calyx 4-lobed; the staminate pedicelled, in pendulous racemes on spur-like branchlets of the previous year; stamens 4; pistillate sessile, in axillary dense globose heads on short peduncles; ovary 1-celled with a long filiform plumose stigma: drupelets oblong, collected into a globose compound; fr. manillate on the surface.—One species in N. Amer. It is sometimes described under *Toxylon*, but this name is replaced with *Maclura* by the "nomina conservanda" of the international rules.

The osage orange is a medium-sized spiny tree with spreading branches, forming an open irregular head, with rather large bright green leaves changing to clear yellow in fall and with inconspicuous greenish flowers followed by greenish yellow orange-like but inedible fruits in the pistillate tree. It is hardy as far north as Massachusetts. It is not particular as to the soil; its roots are very long and voracious feeders. Much planted for hedges chiefly in the Middle West. The bark of the root is used as a yellow dye; that of the trunk sometimes for tanning leather. In Europe the tree is sometimes grown as food for the silkworm. Propagation is usually by seeds, which germinate readily; also by root-cuttings and by greenwood cuttings under glass.

pomifera, Schneid. (*M. aurantiaca*, Nutt. *Tózylon pomiferum*, Raf.). Fig. 2292. Tree, sometimes to 60 ft., with furrowed dark orange-colored bark: branchlets light green, soon glabrous: spines 2-3 in. long: lvs. ovate to oblong-lanceolate, acuminate, soon becoming glabrous, lustrous above, 2-6 in. long: racemes of staminate fls. 1-1½ in. long; heads of pistillate fls. ¾-1 in. across: fr. subglobose, 4-6 in. across, ripening in autumn and soon falling. May, June. Ark. to Texas. S.S. 7:322, 323. G.C. III. 16:693. G.M. 33:808, 809. V. 437. Var. *inermis*, Rehd. (*M. aurantiaca* var. *inermis*, André). A form with spineless branches. R.H. 1896, p. 33.

ALFRED REHDER.

The osage orange, before the advent of wire fences, was an extremely popular hedge plant, meeting general requirements better than any other plant suitable to our climate. It is used considerably, and when properly attended to from the start makes a hedge in a short time of a fairly defensive nature. Most dealers in tree seeds keep seeds of the osage orange, and those who grow the plants procure the seed in spring, drilling it in rows. The osage orange grows readily from seed, even when the latter is a year old. The sowing in rows gives the seedlings a chance to become stocky by fall, and plants 2 feet high the first year are not uncommon. These one-year-old plants are quite good enough for hedging. Nurserymen who grow them for sale usually dig the plants in the fall, storing them away in a cool cellar, the roots buried in sand. They are then sorted into two grades, which compose first- and second-class plants. At the time of grading, the tops are chopped off somewhat, leaving about 6 inches of length only. This fits them for planting without more cutting.

The place where a hedge is desired should be well cleared of all weeds. If cultivated for a year in advance, so much the better, as it will make the keeping down of weeds a much easier task.

There are two ways of planting a hedge; viz., single row and double row. The double row is made by setting the plants 9 inches apart each way, the plants in the second row coming between those in the first row, forming a zigzag line. The single row, however, is good enough, and is much easier to cultivate and keep clear of weeds. In single rows set the plants 6 inches apart.

The soil need not be over-rich for the osage orange. The plant is a strong grower naturally, and soil in fair condition will give a growth more tractable to form a good hedge than a rank growth from rich soil.

When dug, the osage plants have very long roots, and the ends of these may be chopped off without disadvantage. If the plants are held in bunches and the roots chopped to an even length, the setting will be an easy task. The tops will have been already cut off if treated in the way above suggested.

Beyond cultivation of the plants, nothing is required the first year. By fall a good growth should have been made, and toward spring this should be cut back, leaving about 6 inches of the young growth. The season following, more care must be given to forming a hedge. When in full growth, say in July, shear off the tops of the plants. This will cause the side shoots to develop; and it is these side shoots which will form the base of the hedge. Another light trimming should be given when growth is over for the season, to bring the plants into a hedge shape. Much the same work will be required every year,—a trimming when growth is in full swing to make the hedge bushy, and another later on to shape it.

The proper shape for a hedge is the conical form, though it may be flat-sided or in any shape desired, provided the upper branches never overlap the lower.

Of late years a system of planting the osage differing from the one described has been followed by some. Strong two-year-old plants are procured and are planted in a slanting position. As the new growth is made it rises in an upright way as usual, and this produces a lattice-like appearance of the branches, and a very strong hedge. It is certainly stronger than a common hedge, and yet a common one properly looked after forms a defensive fence, meeting all requirements, and costs not nearly so much as the other. See *Hedges*.

JOSEPH MEEHAN.

MACÔDES (from *makos*, length; on account of the long labellum). *Orchidaceæ*. A small group of orchids of the habit of *Anacochilus*.

Terrestrial herbs, with few variegated petioled lvs. at the base, and small fls. borne in a long raceme; sepals and narrower petals spreading; labellum ventricose, with 2 small lateral lobes and 2 calli inside, turned to one side; column short, twisted in the opposite direction, with 2 narrow, erect appendages.—Two or 3 species, with cult. requirements similar to those of *Anacochilus*.

Pétola, Lindl. (*Anacochilus Veitchianus*, Hort. A. *Pétola*, Hort.). Fls. greenish, inconspicuous; lvs. ovate, 2-3 in. long, reticulated, with golden yellow veins. Java. R.B. 21:61. G. 27:55. O.R. 17:73.

javanica, Hook. f. Sts. ereeping or suberect, 6-8 in. long, rosy red; lvs. 3 in. long, 2 in. wide, dark velvety green above, with the nerves pale green and with white reticulations, reddish on the lower surface; fls. orange-red, white-tipped. Java. G.C. III. 39:216. B.M. 7037.

GEORGE V. NASH.†

MACROCHÓRDUM (*long or large tube*). *Bromeliaceæ*. A few S. American plants usually referred to *Echmea*. *M. strictum*, Beer, is referred by Mez to *Echmea bromeliifolia*, Baker. (See p. 222, Vol. I.) The species is characterized by white-seamy lvs., simple dense, woolly spikes overtopping the foliage; fls. with yellowish green calyx and small exserted purple-black petals. *M. luteum*, Regel & Lindl. = *Echmea calyculata*; *M. pulchrum*, Beer, and *M. tinctorium*, De Vriese, also = *Echmea bromeliifolia*.

MACROPÍPER (*long or large piper*). *Piperaceæ*. A few shrubs of the Pacific Isls., by some included in *Piper*, but separated by the monopodial rather than sympodial growth of the flowering shoots, and by minor characters. Probably none is in the trade, although a form of the following is mentioned in recent horticultural literature. *M. excelsum*, Miq. (*Piper excelsum*, Forst.). Glabrous densely branched aromatic shrub or small tree to 20 ft., in Tahiti, Norfolk Isl., New Zeal.,

and elsewhere; branches jointed and swollen; lvs. alternate, stalked, broad-ovate or broader, 7-nerved, yellow-green, the petiole winged below; spikes dense, solitary or in 2's, bearing minute unisexual fls.; stamens 2 or 3; stigmas 3 or 4; fr. small yellow berries, densely compacted. Var. *aureo-pictum*, Hort., has a large cream-colored or yellow blotch on the lf. G.Z. 21, p. 74.

For *M. methysticum*, Hook & Arn., and further discussion, see *Piper*.

L. H. B.

MACROPLÉCTRUM (Greek, *long-spurred*). *Orchidaceæ*. Caulescent plants, in habit and cultural requirements like *Vanda*, with numerous distichous leaves, the flowers with long spurs.

Sepals and petals similar, spreading; lip rigidly attached to the base of the column, entire; column short and thick; pollinia 2, upon separate and distinct membranous caudicles.—Several species in Madagascar and the Mascarin Isls. In *M. sesquipedale*, the long spur or tail-like appendage is sometimes 18 in. long. Darwin predicted when he saw the plant first that a moth



2293. *Macropléctrum sesquipedale*.

would be found some day in Madagascar with a tongue long enough to reach down to the nectar, and it was, years afterward.

sesquipedale, Pfitz. (*Angræcum sesquipedale*, Thouars. *Aëranthus sesquipedalis*, Lindl.). Fig. 2293. Sts. 2-3 ft. tall; lvs. oblong-ligulate, 12 in. long and up to 2 in. broad, unequally 2-lobed; peduncle 2-5-fld.; fls. 5-7 in. across, fleshy, ivory-white; sepals and petals similar, acuminate; lip oblong-ovate, cordate, acuminate, irregularly serrate. Madagascar. A.G. 13:217. A.F. 7:831. Gn. 2, p. 5. F.S. 14:1413. B.M. 5113. G.M. 38:294; 47:494; 49:95. O.R. 9:49. C.L.A. 17:429. G. 18:365. G.C. III. 45:399. Gn.W. 10:421. Gt. 58, p. 55. J.H. III. 44:337; 64:393.

Leônís, Nash (*Angræcum Leônís*, Veitch. *Aëranthus Leônís*, Reicheb. *Angræcum Humboldtii*, Reicheb. f.). Lvs. falcate, fleshy, equitant, flattened laterally; raceme of 8 or less white fls., 2-3 in. across, on winged pedicels; sepals and petals lanceolate; lip cordate, cuspidate; spur 4-6 in. long, curiously bent a part way down in the direction of the fl. Comoro Isl. G.C. II. 24:80, 81.

GEORGE V. NASH.

MACROSCÈPIS (Greek, *long or large, and to cover*). *Asclepiadaceæ*. Tropical American climbers, somewhat grown in the warmhouse.

Tall twining, setose-hirsute; lvs. opposite, large, cordate; cymes crowded; fls. rather large and usually showy; calyx about 5-parted; corolla-tube ovoid or broadly cylindrical and constricted at the throat;

limb 5-lobed, spreading; scales of the crown 5, inflexed under the throat of the fleshy corolla; stamens inserted near base of tube, the filaments connate into a short tube; follicles hard and thick.—Species few.

elliptica, N. E. Br. Twining, long-hirsute: lvs. 6–7 in. long, elliptic, cuspidate-acuminate, cordate at base, long-petioled: fls. 8–10 in an umbel, each fl. about 1 in. diam., resembling those of *Hoya carnosa* in shape, soft velvety brown; sepals about ½ in. long, oblong-lanceolate; corolla 5-lobed, green at the throat; lobes of the crown fleshy, deltoid, incurved, whitish. Brazil.

L. H. B.

MACROSTIGMA: *Tupistra*.

MACROTOMIA: *Arnebia* (*A. echinoides*), by some kept as a distinct genus.

MACROZAMIA (Greek, long or large, *Zamia*). *Cycadaceæ*. Cycas-like plants, grown under glass and suitable for the open far South.

The genus is less allied to *Cycas* than to *Dioon* and *Encephalartos*, from which it is distinguished by the following characters: lvs. pinnate: scales of the female cones peltate, the shield thickened, ascending, usually produced into an erect, acuminate blade. It is to Austral. what *Encephalartos* is to S. and Cent. Afr., but that genus differs, according to Bentham, in much more rigid habit and very obtuse or truncate cone-scales. It is closely allied to the American *Zamia*, which differs in its cones and the articulate attachment of the pinnæ. —A dozen and more species in Austral., which, like most of the members of this order, make noble foliage plants for private conservatories. They have the trunk and lvs. of cycas, except that the pinnæ have no midrib but are more or less distinctly striate, especially on the under side, with several parallel equal veins, the whole lf. occasionally twisted in some species, but not constantly so in any one. The treatment in this account is adapted from Bentham.

Macrozamia is representative rather than useful subjects, and not frequently seen. They combine poorly in any scheme of plant and flower decoration; but as single specimens, they always attract attention, and in a grouping of similar subjects, or with aloe, agaves and yuccas they make an effective combination. Their culture is easy. Sandy soil, with charcoal, to keep the soil sweet, ordinary greenhouse temperature, plenty of water during the growing season, which corresponds to our summer, and rest in winter, are the essentials. (T. D. Hatfield.)

A. Pinnæ very narrow, often nearly terete: cones small, rarely above 4 in.; fr. very woolly.

Paulo-Guilielmi, Hill & Muell. (*M. plumosa*, A. Mohr.). Trunk short, scarcely protruding from the ground, bearing the woolly bases of old petioles: lvs. 1–3 ft. long, the rachis narrow and often flat on top; pinnæ many, very narrow or even almost terete, contracted at the base: male cones about 3 in. long; females about 4 in. long and half as thick. R.H. 1877, p. 254. G.Z. 20, p. 64.

AA. Pinnæ flat, inserted on the margins of the rachis, contracted at the base: cones 4–10 in., glabrous.

B. Rachis of lvs. usually raised longitudinally between the pinnæ: cone-scales much flattened.

spirâlis, Miq. Trunk short: lvs. 2–4 ft. long: pinnæ with mostly longitudinal insertion, flat, straight or slightly falcate, to 8 or 10 in. long, slightly contracted and callous at base, lower margin slightly decurrent, marked on underside with parallel longitudinal veins: male cones 6–10 in. long, with much flattened scales; female cones usually shorter and thicker than the males, the scales with incurved short point. G.C. III. 13:74. —*M. cylindrica*, Hort., Bentham considers a doubtful variety of *M. spirâlis*, being smaller, with the narrow foliage nearly of *M. Paulo-Guilielmi*, but with a gla-

brous trunk and more terete rachis. *M. corâllipes*, Hook. f., has the callous base of the pinnæ bright red. B.M. 5943. G.Z. 21, p. 170.

BB. Rachis of lvs. very flat between the pinnæ and often broad: cone-scales very thick.

Miquélii, F. Muell. Typically with base of petioles woolly, rachis broad and flat and cone-scales thick, but variable: lvs. 2–4 ft. long; pinnæ usually longer than in *M. spirâlis*, straight or falcate, the longitudinal veins finer and less prominent: male cones 6–8 in. long, cylindrical; female about as long and thicker, the scales mostly with a long point. *M. Mackénzei* is apparently a form of this species. G.Z. 22, p. 49.

AAA. Pinnæ inserted by their broad base along the center of the upper surface of the rachis, scarcely separated by a very narrow line: cones large, pubescent, the scale points broad and often recurved.

Peroffskyâna, Miq. (*M. Perowskiana* and *M. Denisovii*, F. Muell.). Large, the trunk 18–20 ft. high and 1 ft. or more diam.: lvs. 7–12 ft. long, with angular petioles; pinnæ 1–2 ft. long and ½ in. broad, the parallel veins finely marked and very obscure, only slightly contracted at base: male cones ovoid, 4–6 in. long and 3–4 in. diam.; females 8–16 in. long and very thick.

WILHELM MILLER.

L. H. B.†

MADDÈNIA (after Major E. Madden, who wrote on Indian botany). *Rosicææ*, subfam. *Prunææ*. A genus of 5 shrubs or small trees allied to *Prunus*, especially to the section *Padus*, differing chiefly in the polygamous apetalous fls. with usually 10 small sepals, the staminate often with 2 abortive pistils; stamens 25–40. Only the following species is in cult., and has proved hardy at the Arnold Arboretum, but has no particular ornamental qualities. Cult. like *Prunus*. *M. hypoxantha*, Koehne. Shrub or small tree, to 20 ft.; branchlets sparingly hairy: lvs. membranous, oblong to lanceolate, acuminate, cordate to broadly cuneate at the base, doubly and sharply serrate, glabrous above, pubescent on the veins and bright or yellowish green beneath, 3–6 in. long, with 12–20 pairs of veins: racemes long-peduncled, dense and short; calyx about ½ in. long, with 10 unequal small teeth, stamens about 25: drupe subglobose, black, little over ½ in. long. May; fr. in July. W. China.

ALFRED REHDER.

MADDER: Root of *Rubia tinctorum*.

MADEIRA VINE: *Boussingaultia*.

MADIA (*Madi*, the Chilean name of the common species). *Compositæ*. Yellow-flowered herbs confined to the western part of the American continent, sometimes grown in the flower-garden.



2294. *Madia elegans*.

The nearest genus of garden value is *Layia*, from which *Madia* is distinguished by the following characters: involucre deeply sulcate, bracts strongly infolding and thus inclosing the achenes of the rays which are laterally compressed; achenes of the disk fertile or sterile. Their fls. are remarkable for closing in the sunshine, and opening in the morning or evening. Species about a dozen.

They are all called tarweeds from their glandular, viscid, heavily-scented foliage, the common tarweed of California being var. *congesta* of *M. sativa*, which is a useful annual plant for sheep pastures in dry, warm soil. *M. elegans* is an interesting ornamental annual. It has a graceful open habit (see Fig. 2294) and distinct flowers (Fig. 2295), which become more numerous as the summer advances.

A. Rays showy.

B. Plant annual: lvs. chiefly alternate: pappus none. *elegans*, D. Don. Figs. 2294, 2295. Height 1-4 ft.: lvs. linear or lanceolate, mostly entire; rays acutely 3-lobed, yellow throughout or with a brown spot at the base. Calif. and Ore. to Nev. B.M. 3548. B.R. 1458.—Needs a shady place.



2295. *Madia elegans*.
(Natural size)

Bn. Plant perennial: lvs. mostly opposite: pappus present in disk-fls.

madioides, Greene (*Anisocarpus madioides*, Nutt. *Madia Nuttallii*, Gray). Slender, not over 1-2 ft.: lvs. linear-lanceolate, sometimes dentate; heads paniculate, usually short-stalked. Woods, Brit. Col. to Monterey, Calif.

Aa. Rays inconspicuous, about 2 lines long.

sativa, Molina. A glandular and sticky, heavy-scented annual about 1-3 ft.: lvs. from broadly lanceolate to linear: rays 5-12, with honey-yellow ligules about $\frac{1}{4}$ in. long. Ore., Calif., Chile, perhaps native in S. Amer. N. TAYLOR.†

MÆSA (from *maïss*, the Arabian name of *Marsa lanceolata*). *Myrsinaceæ*. A group of about 100 shrubs found throughout the tropical and subtropical regions, except Amer., differing from all other Myrsinaceæ in the many-seeded fr. and the half-superior ovary. Lvs. alternate, petioled, entire or serrate, without stipules: fls. small, white, in axillary racemes or panicles, rarely terminal; calyx 5-lobed; corolla campanulate or urceolate, 5-lobed; stamens affixed to the corolla-tube, opposite the lobes, included; ovary half-superior, 1-celled, with many ovules on a central placenta; style cylindrical with capitate stigma: fr. berry-like, many-seeded, crowned by the persistent calyx and style. The following species are occasionally grown in S. Calif. and *M. argentea* as a greenhouse shrub in botanical gardens in Eu. Prop. by seeds and probably by cuttings. *M. argentea*, Wall. Large shrub with stout branches, densely brownish pubescent while young; lvs. membranous, elliptic to elliptic-oblong, dentate, dull green above and more or less pubescent on both sides, 4-8 in. long; fls. white, scarcely $\frac{1}{4}$ in. long, in short racemes $\frac{1}{2}$ -1 in. long; fr. globose, whitish, $\frac{1}{4}$ in. across or less. Himalayas. *M. indica*, Wall. Tree, to 30 ft.: lvs. coriaceous, glabrous, elliptic, dentate, about 5 in. long; racemes axillary, shorter than lvs. India. Bears edible berries. *M. macrophylla*, Wall. Shrub, 6-14 ft.: branches pubescent; lvs. broadly elliptic, softly hairy

on both surfaces, dentate, to 6 in.: racemes paniced, often as long as lvs.: berries rusty red, not edible. India.

ALFRED REIDDER.

MAGNOLIA (after Pierre Magnol, professor of medicine and director of the botanic garden at Montpellier, 1638-1715). *Magnoliaceæ*. Woody plants grown chiefly for their showy white, pink or purple flowers and also for their handsome foliage; mostly spring-blooming.

Deciduous or evergreen trees and shrubs, with rather stout branches marked with conspicuous lf.-scars: lvs. alternate, entire; the stipules usually adnate to the petiole and inclosing the young successive lf.: fls. terminal, solitary, the buds inclosed in a stipular spathe; sepals 3, often petaloid; petals 6-15; stamens and carpels numerous, the latter connate into a spindle, developing into a cone-like somewhat fleshy or leathery fr., with dehiscent, 1-2 seeded carpels; the large, usually scarlet seeds often suspended for a time from the fr. by thin threads.—About 35 species in N. and Cent. Amer., Himalayas and E. Asia. The wood is close-grained, usually light and satiny, but not durable; that of *M. hypoleuca* is much used in Japan for lacquered ware; the bark and fr. of some species have been used medicinally as a tonic and stimulant.

The magnolias are highly ornamental and popular, with large white, pink or purple, rarely yellowish flowers, often fragrant; the cone-shaped fruits are often pink or scarlet and very decorative. Most of the deciduous species are fairly hardy, at least in sheltered positions, as far north as northern New York and Massachusetts, and *M. acuminata*, *M. Kobus* and *M. stellata* even farther north, while *M. Campbellii* is the most tender. Of the evergreen species, *M. grandiflora*, one of the most beautiful native trees, is precariously hardy north to Philadelphia. The Asiatic deciduous species are among the most showy and striking of the early-flowering trees and shrubs; the earliest is the shrubby *M. stellata*, blooming in mild climates in March, and after this *M. denudata* comes into bloom, closely followed by *M. Soulangiana* and after this *M. liliflora*. The handsomest of the deciduous species is probably *M. hypoleuca*, with the very large leaves silvery white below and with showy, sweet-scented flowers; also the American *M. macrophylla* and *M. tripetala* are conspicuous by their very large foliage. The magnolias are usually planted as single specimens on the lawn, and there are, perhaps, no plants more striking against a background of dark green conifers. Some species, as *M. grandiflora* in the South and *M. acuminata* farther north, are fine avenue trees. The magnolias thrive best in somewhat rich, moderately moist and porous soil, preferring sandy or peaty loam, but some kinds which usually grow naturally on the borders of swamps, as *M. glauca*, thrive as well in moist and swampy situations. Transplanting is difficult and is most successfully performed just when the new growth is starting. Propagation is by seeds sown immediately or stratified, and by layers of last year's growth put down in spring and tongued, or notched. Layers are usually severed and transplanted the following spring, but as many of them die after transplanting, it is a safer way to take them off early in July, when the new growth has ripened, plant them in pots and keep in a close frame until they are established. Varieties and rarer kinds are often veneer- or side-grafted in early spring or summer on potted stock in the greenhouse or frame; as a stock *M. tripetala* is perhaps the best on account of its better fibrous roots, which render transplanting safer, but *M. acuminata* is also a good stock. Sometimes increased by greenwood cuttings taken with a heel and handled under glass.

Magnolias in the South.

Evergreen kinds. (P. J. Berekmans.)

Among the finest magnolias cultivated in the South are the two native evergreen species, *M. grandiflora* and



LXVII. *Magnolia Soulangiana*, the commonest hybrid magnolia in the North.

M. glauca, and the exotics *M. Coco* (*M. pumila*) and *M. fuscata*, the last being now referred to *Michelia*. *Magnolia grandiflora* is a noble tree. It is native of the middle and southern sections of Georgia, South Carolina, Alabama, Louisiana and the upper districts of Florida, and is recognized as one of the grandest of all broad-leaved evergreen trees. In its native habitat it attains a height of 75 to 100 feet, with very large, oval or lanceolate coriaceous leaves. The latter vary, however, from very broad to rather narrow, some with a rusty under surface, others quite smooth. The flowers vary also in size, the largest frequently measuring 10 to 12 inches in diameter when fully expanded; others do not attain more than half that size. They appear early in May, in some sections during the latter part of April, and continue until the end of June. Some trees produce a few flowers during August, and even as late as October, but these are exceptions. Each flower lasts from two to four days, when the petals fall and the cone-like fruit appears. This gradually increases in size until September, when the bright coral-red seeds are detached and hang on long filaments. The seed should be gathered when fully ripe, put in dry sand until February in the South, then in moist sand for a week or ten days, when the resinous cuticle can be removed by washing. Sow the cleaned seed in a box or coldframe, and as the plants show their second leaves pot off in small pots. In July, give a larger-sized pot, and the plants will be sufficiently large to plant in permanent place during the following autumn or winter. It is always advisable to take pot-grown plants, as they succeed better than plants taken up with bare roots. Magnolias are voracious feeders, and require rich soil and an abundance of plant-food. Their roots extend to a great length, and to bring out the stately beauty of this tree they should be given ample space. The wood is white, and valued for cabinet-work. There are many forms cultivated in European nurseries, their main characteristics being in the size and form of the leaves and size of flowers. They are propagated by grafting, either by inarching or cleft- or tongue-graft. The latter should be done under glass, taking two-year-old pot-grown seedlings. The fragrance of the flowers varies also, some flowers being more pungent than others, but, as a rule, the fragrance is pleasant. The principal varieties are *M. grandiflora* var. *gloriosa*, with flowers often measuring 14 inches in diameter; foliage broad and massive, brown on under surface. The tree seldom grows beyond 40 feet. Var. *præcox*, or early-flowering. Var. *rotundifolia*, with very dark green roundish leaves, rusty underneath.

Magnolia glauca, the sweet bay, is an evergreen tree in the southern states, becoming deciduous northward. It attains a height of 30 feet in rich bottoms or swampy lands: leaves oval, long or elliptical, with a glaucous under surface: flowers white, 3 to 4 inches in diameter, very fragrant, and produced from May to July. This tree is not sufficiently appreciated as an ornamental in landscape gardening.

Magnolia Coco (*M. pumila*, or *Talauma pumila*) is a very dwarf Chinese species, seldom growing more than 4 or 5 feet high: leaves smooth, elliptical, sharp-pointed, coriaceous: flowers 1 to 1½ inches in diameter, white or slightly tinged green, with six to nine fleshy petals, which drop soon after the flowers expand. The fragrance is intense at night, and resembles a ripe pineapple. It thrives best in a rich, partially shaded soil, but a frost of 10° below the freezing-point will injure it. It is therefore best to grow it as a conservatory plant. Propagate by ripened wood cuttings in bottom heat. As this plant is in bloom during nearly the whole year, and its delicate fragrance is unsurpassed, it is strange that it is so little known.

Deciduous kinds. (L. A. Berekmans.)

Magnolia acuminata (cucumber tree) is an upright-growing variety, with spreading branches, especially

desirable for the upper sections, where it attains an immense size: leaves oblong, bright green: greenish yellow flowers produced in late spring.

Magnolia cordata is an exceedingly rare variety found only near Augusta, Georgia, and the western part of South Carolina: leaves oval: flowers about 3 inches long, lemon-yellow. Forms a small tree. Does well in sandy soil.

Magnolia denudata (Yulan) is a native of China with pure white flowers produced in early spring before the leaves appear. It attains an ultimate height of not more than 20 feet.

Magnolia Fraseri has leaves 8 to 12 inches long and produces white flowers 3 to 4 inches wide. This is a hardy variety and is especially adapted to the upper section. Attains a height of 25 to 50 feet. Found naturally from Virginia to Florida.



2296. *Magnolia Thompsoniana*. (× 1/4)

Magnolia Kobus, from Japan, is of pyramidal growth with short and slender branches: leaves 4 to 5 inches long: flowers pure white, appearing before the leaves. A desirable early-flowering species.

Magnolia macrophylla (great-leaved magnolia) is a symmetrical-growing variety with wide, spreading branches, growing naturally as far south as Florida: leaves 18 to 24 inches in length, 9 to 10 inches wide, bright green above, silvery beneath: flowers 10 to 12 inches in diameter, white, disagreeable odor. Tree attains a height of 20 to 50 feet.

Magnolia Soulangeana (Soulang's magnolia) is a magnificent tree of garden origin and is supposed to be a hybrid between *Magnolia liliflora* and *Magnolia denudata*: leaves dark green, expanding after the flowers have passed: flowers large, eup-shaped, creamy white, more or less suffused with pink; blooms in March: hardy: ultimate height, 25 feet. Var. *nigra* (dark-flowered magnolia) is a variety of vigorous and robust growth: flowers large, dark purple, several shades darker than *Magnolia liliflora*, a free bloomer; begins to bloom in March and blooms spasmodically during the entire summer. In var. *Lennei* (Lenne's magnolia) the flowers are deep crimson on the outside; blooms a little later than the type. Var. *speciosa* is almost identical in color with the species but more eup-shaped and petals broader.

Magnolia stellata (*M. Halleana*, starry magnolia) is of dwarf habit: flowers semi-double, pure white and very fragrant. Blooms from two to three weeks earlier than any other magnolia; very hardy.

Magnolia tripetala (umbrella magnolia) is a tree 20 to 40 feet high: leaves dark green, light underneath: flow-

ers 8 to 10 inches in diameter, white; leaves 10 to 21 inches long, 6 to 8 inches broad. Found from Pennsylvania to Mississippi.

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KEY TO THE SPECIES.

- A. Blossoms appear after or with the lvs.:
fr. subglobose to oblong, cone-like,
usually symmetrical.
- B. Foliage deciduous.
- C. Fls. white, large.
- D. Base of lvs. cordate.
- E. Lf-buds and branches tomentose: lvs. scattered, 20-30 in. long. 1. *macrophylla*
- EE. Lf-buds and branches glabrous: lvs. crowded at the end of the flowering branchlets, 5-12 in. long.
- F. Lvs. acute: tips of mature carpels nearly straight. 2. *Fraseri*
- FF. Lvs. obtusely pointed: tips of mature carpels incurved. 3. *pyramidata*
- DD. Base of lvs. narrowed, rarely rounded or subcordate.
- E. Length of lvs. 5-24 in.; lvs. crowded at the end of the branches: buds and branchlets glabrous.
- F. Filaments whitish: fr. 2½-4 in. long.
- G. Fls. 8-10 in. across: lvs. 12-24 in. long. 4. *tripetala*
- GG. Fls. 5-6 in. across: lvs. 5-9 in. long. 5. *Thompsoni*
- FF. Filaments purple: fr. 5-7½ in. long. 6. *hypoleuca*
- EE. Length of lvs. 3-7 in.; lvs. scattered.
- F. Shape of lvs. elliptic-oblong to oblong-lanceolate, 3-5 in. long.
- G. Under side of lvs. glabrous except the rufous-pubescent midrib. 7. *Nicholsoni*
- GG. Under side densely silky tomentose. 8. *Wilsonii*
- FF. Shape of lvs. oval to elliptic, sparingly appressed pubescent beneath or glabrous, 4-7 in. long.
- G. Peduncles and petioles glabrous or nearly so: fls. short-stalked. 9. *Watsonii*
- GG. Peduncles and petioles pubescent: fls. slender-stalked. 10. *parviflora*
- CC. Fls. greenish or yellow: lvs. 7-10 in. long, sometimes rounded or subcordate at the base. 11. *acuminata*
- BB. Foliage evergreen (half-evergreen or deciduous N. in No. 12).
- C. Petals 6-12; fls. upright.

- D. Lvs. glabrous or silky pubescent beneath.
- E. Number of petals 9-12: deciduous or half-evergreen. 12. *glauca*
- EE. Number of petals 7 or 8: evergreen trees.
- F. Length of lvs. 5-7 in., obtusely acuminate: petals 1½ in. long. 13. *splendens*
- FF. Length of lvs. 8-12 in., usually rounded: petals 4 in. long. 14. *Delavayi*
- DD. Lvs. ferruginous-pubescent beneath: petals 6-12, 3-5 in. long. 15. *grandiflora*
- CC. Petals 6; sepals green; fls. nodding, globular, 1½ in. across. 16. *Coco*
- AA. Blossoms appearing before the lvs. (with the lvs. in No. 19): fr. cylindric, unsymmetrical, usually curved and twisted.
- B. Sepals 3, narrow and much shorter than petals.
- C. Fls. white.
- D. Lvs. oblong-lanceolate or narrow-elliptic, broadest below the middle, membranous. 17. *salicifolia*
- DD. Lvs. obovate to obovate-oblong, broadest above the middle, chartaceous. 18. *Kobus*
- CC. Fls. purple, rarely nearly white.
- D. Sepals much shorter than petals, green, lanceolate; petals purple outside. 19. *liliflora*
- DD. Sepals usually half as long as petals, usually petaloid; fls. sometimes nearly white. 20. *Soulangeana*
- BB. Sepals and petals alike.
- C. Petals 9, usually white; lvs. obovate, 3-6 in. long. 21. *denudata*
- CC. Petals 9-18.
- D. Lvs. obovate-oblong, 2-3½ in. long; fls. 3 in. across, usually white. 22. *stellata*
- DD. Lvs. elliptic to elliptic-oblong, 5-12 in. long; fls. 6-10 in. across, pink outside. 23. *Campbellii*

1. *macrophylla*, Michx. LARGE-LEAVED CUCUMBER TREE. Tree, to 50 ft., with spreading branches: lvs. oblong-obovate, blunt, subcordate-auriculate at the base, glaucescent and finely pubescent beneath, 1-3 ft. long; fls. cup-shaped, fragrant, 10-12 in. across; petals 6, oblong-obovate, thick, purplish at the base, 6-7 in. long; fr. broadly ovate, rose-colored, to 3 in. long. May, June. Ky. to Fla., west to Ark. and La. S.S. 1:7, 8. B.M. 2981. G.F. 8:165. Gn. 22, p. 28; 24, p. 509; 33, p. 539. F.R.S. 1, p. 14. F.E. 14, p. 23. G.C. III. 28:324. Gn. M. 7:230.

2. *Fraseri*, Walt. (*M. auriculata*, Lam.). Tree, to 40 ft., with wide-spreading branches, quite glabrous: lvs. spatulate-obovate, cordate-auriculate at the base, acute, glaucescent beneath, 8-20 in. long; fls. 6-9 in. across, sweet-scented; petals 6-9, oblong-obovate, contracted below the middle, 4-5 in. long; fr. oblong, bright rose-red, 3-5 in. long. Va. to Fla., west to Miss. S.S. 1:11 and 12. B.M. 1206. Gn. 22, p. 27; 24, p. 511; 44, p. 935. F.E. 33:1071. Gn.M. 5:150. C.L.A. 5:494.

3. *pyramidata*, Pursh. Slender tree, to 30 ft., with ascending branches, glabrous: lvs. obovate-spatulate, cordate-auriculate at the base, abruptly narrowed into a blunt point, glaucescent beneath, 5½-8½ in. long; fls. 3½-4 in. across; sepals much shorter than petals; petals 6-9, oblong-obovate, gradually narrowed toward the base; fr. oblong, bright rose, 2-2½ in. long. June. Ga. to Fla. and Ala. S.T.S. 1:51. S.M. 324. B.R. 407. L.B.C. 11:1092.

4. *tripetala*, Linn. (*M. Umbrella*, Lam.). UMBRELLA TREE. Tree, to 40 ft., with spreading branches, forming an open head: lvs. tapering toward the base, oblong-obovate, acute, pale and pubescent beneath when

young, 12-24 in. long; fls. 8-10 in. across, of a disagreeable odor; petals 6-9, oblong-obovate, 4-5 in. long; sepals recurved, light green; fr. rose-colored, ovate-oblong, 2½-4 in. long. May. Pa. to Ala., west to Ark. and Miss. S.S. 1:9, 10. Gn. 22, p. 27; 24, p. 509; 33, p. 539. C.L.A. 5:494.

5. *Thompsoniana*, Sarg. (*M. glauca* var. *major*, Sims. *M. glauca* var. *Thompsoniana*, Loud.). Fig. 2296. Hybrid of *M. glauca* and *M. tripetala*. Shrub or small tree; branches and buds glabrous; lvs. oval to oblong, acute, glaucescent beneath and pubescent when young, 5-9 in. long; fls. white, fragrant, 5-6 in. across; sepals shorter than the petals, yellowish. June, July. G.F. 1:269 (adapted in Fig. 2296). B.M. 2164. Gn. 24, p. 511.—Of garden origin; tenderer than either one of the parents.

6. *hypoleuca*, Sieb. & Zucc. (*M. obovata*, Thunb.). Fig. 2297. Tree, to 100 ft. high, with broad, pyramidal head; branches purplish; lvs. obovate to obovate-oblong, obtusely pointed, glaucous and appressed pubescent beneath, 8-14 in. long; fls. 6-7 in. across, cup-shaped, fragrant, with 6-9 petals; stamens with purple filaments; fr. oblong-cylindric, scarlet, to 8 in. long. May, June. Japan. G.F. 1:305 (adapted in Fig. 2297). Mn. 3, p. 73. B.M. 8077. F.S.R. 3, p. 251. S.I.F. 1:39. G. 27:659. Gn.M. 5:151. G.W. 3, pp. 85, 87. M.D. 1904:1; 1912, p. 337.—One of the most beautiful of the deciduous species, the under side of the lvs. being almost silvery white; about as hardy as *M. macrophylla*. The name *M. hypoleuca* is used here, instead of the oldest name, *M. obovata*, to avoid confusion, as the latter name has been applied erroneously by most botanists to the plant named here *M. liliflora* (for further remarks on the nomenclature of this and other species, see Sargent, Plant. Wilson. 1:400, 403, 406).

7. *Nicholsoniana*, Rehd. & Wilson. Shrub or small tree, to 20 ft.: branchlets sparingly pubescent; lvs. slender-petioled, elliptic-oblong to obovate-oblong, acute or short-acuminate, glabrous above, glaucescent beneath and glabrous except the densely rufous-pubescent midrib, 3-5 in. long; fls. white, cup-shaped, about 4 in. across; sepals and petals usually 12, the inner row shorter; filaments and carpels red; fr. oblong-cylindric, 1½-2 in. long. June. W. China.

8. *Wilsonii*, Rehd. (*M. parviflora* var. *Wilsonii*, Finet & Gagnep.). Shrub or small tree, to 20 ft.: branchlets pubescent; lvs. slender-petioled, elliptic-lanceolate, rarely elliptic-ovate, acute or short-acuminate, sometimes subcordate at the base, glabrous above, densely silky tomentose beneath, 3-5 in. long; fls. white, cup-shaped, fragrant, 4-5 in. across; sepals and petals usually 9, of equal size; filaments and carpels red; fr. oblong-cylindric, about 2½ in. long. June. W. China.

9. *Watsonii*, Hook. Closely allied to the former: almost glabrous, except lvs. beneath when young; lvs. obovate to oblong, 4-7 in. long; fls. short-stalked, 5-6 in. across, with 6-9 petals; carpels many. June. Japan. B.M. 7157. G.C. III, 16:189; 17:517. Gt. 48:1459. Gng. 1:8. Gn. 24:508 (as *M. parviflora*) probably belongs here. G. M. 34:305. Gn. M. 5:151. R.B. 31, p. 258. C.L.A. 5:495.—Very handsome in bloom; the beauty of the large, sweet-scented fl. is much heightened by the crimson center, formed by the bright colored stamens.

10. *parviflora*, Sieb. & Zucc. (*M. Oyama*, Kort). Small tree; branchlets and buds appressed pubescent; lvs. elliptic to obovate-oblong, obtusely pointed, glaucescent beneath and pubescent at first, 4-6 in. long; fls. long-pedicelled, cup-shaped, white, with large pink sepals, 3-4 in. across, fragrant; petals usually 6; stamens crimson; carpels few. June. Japan. B.M. 7411. Gn. 54, p. 177; 60, p. 81. F.S.R. 2:88. G. 33:373; 36:591. Gng. 1:8; 3:3. G.M. 38:66.

11. *acuminata*, Linn. CUCUMBER TREE. Tall, pyramidal tree, to 90 ft.: lvs. oval to oblong, shortly acuminate, rounded or acute at the base, soft pubescent and light green beneath, 6-9 in. long; fls. greenish yellow or glaucous green, about 2-3½ in. high, with upright petals; fr. cylindric, pink, 3-4 in. long. May, June. N. Y. to Ga., west to Ill. and Ark. S.S. 1:4 and 5. B.M. 2427. L.B.C. 5:418. Gn. 24, p. 509. F.E. 20:64 (pl. 102); 32:331. R.H. 1912, p. 427. Var. *cordata*, Sarg. (*M. cordata*, Michx.). Lvs. broader, rounded or sometimes cordate at the base; fls. smaller, canary-yellow. S. C., Ala. S.S. 1:6. B.M. 2427. L.B.C. 5:474. Gn. 22, p. 27; 24, p. 509.

12. *glauca*, Linn. (*M. virginiana*, Morong). SWEET, SWAMP or WHITE BAY. BEAVER TREE. Fig. 2298. Attractive shrub or small tree, evergreen S.: lvs. oval to oblong-lanceolate, glaucous beneath and silky-pubescent at first, 3-6 in. long; fls. white, globose, fragrant, 2-3 in. across; sepals nearly as large as petals, spreading; petals 9-12, roundish obovate; fr. pink, 1-2 in. long. May, June. Mass. to Fla. near the coast, in the S. extending west to Texas. S.S. 1:3. Em. 2:603. L.B.C. 3:215. R.H. 1894, p. 347. G.F. 10:403. C.L.A. 5:493. G.W. 14, p. 205. Gng. 4:342. Gn. 78, p. 378.—A very desirable shrub, with handsome, glossy foliage and sweet-scented, creamy white fls. Var. *longifolia*, Loud., has lanceolate lvs. and continues blooming during a longer time than the type.

13. *splendens*, Urban. LAUREL SABINO. Evergreen tree, to 80 ft.: branchlets appressed-pubescent; lvs. ovate or elliptic-ovate, obtusely acuminate, rounded at the base, glabrous and glossy above, covered with a lustrous silky tomentum beneath, 4-7 in. long; fls. on stalks ¾ in. long; sepals 3, green, obovate-oblong; petals about 8, white, obovate, 1¾ in. long; fr. oval, about



2298. *Magnolia glauca*. (×¼)



2297. *Magnolia hypoleuca*. (×½)

1 in. long. June–Aug. Porto Rico.—Suited for tropical and subtropical regions only.

14. *Delavayi*, Franch. Evergreen shrub or tree, to 30 ft.: branchlets glabrous; lvs. ovate to ovate-oblong, obtuse and usually mucronate, rounded at the base,



2299. *Magnolia Kobus* var. *borealis*. ($\times \frac{1}{4}$)

glabrous above except the midrib, puberulous beneath and pruinose, pubescent on the midrib, 8–13 in. long; fls. creamy white, fragrant; sepals 3, oblong, $3\frac{1}{2}$ in. long; petals about 7, oblong-obovate or spatulate-obovate, $3\frac{1}{4}$ – $4\frac{1}{4}$ in. long; carpels tomentose below; fr. ovoid-oblong, $4\frac{1}{4}$ – $5\frac{1}{2}$ in. long. July. W. China. B.M. 8282. G. 35:639.—Probably as hardy as *M. grandiflora*.

15. *grandiflora*, Linn. (*M. fatida*, Sarg.). BULL BAY. Tall evergreen tree, to 80 ft., of pyramidal habit: branchlets and buds rusty-pubescent; lvs. thick and firm, oblong to obovate, glossy above, ferrugineous-pubescent beneath, sometimes glabrous at length, 5–8 in. long; fls. white, fragrant, 7–8 in. across; sepals large, petaloid; petals 6–12, obovate; stamens purple; fr. oval or ovate, rusty brown and pubescent, 3–4 in. long. May–Aug. N. C. to Tex. S.S. 1:1, 2. Gn. 22, p. 28; 24, pp. 509, 511; 33, p. 538. J.H. III. 52:237. G. 2:567; 9:225; 19:153; 36:187. G.W. 3, p. 377. F.E. 17:788, p. 781. Var. *angustifolia*, Lond. (var. *salicifolia*, Hort.). Lvs. lanceolate, wavy. Var. *lanceolata*, Ait. Lvs. oblong-lanceolate or oblong-elliptic, less rusty beneath. B.M. 1952. L.B.C. 9:814. There are many other named varieties, as: var. *gloriosa*, Hort., with fls. to 14 in. across and broad lvs.; var. *rotundifolia*, Hort., with very dark green roundish lvs.; var. *præcox*, Hort., early-flowering; var. *obovata*, Nichols., with obovate-oblong lvs.; var. *Kathariniana*, Bedelian, with very broad lvs. and smaller fls. with narrower petals; var. *galissoniensis*, Hort., one of the hardiest forms; var. *Pravertiana*, Hort., of stubby pyramidal habit; var. *exoniensis*, Loud. (var. *stricta*, Hort. *M. oxoniensis*, Hort.), of vigorous growth and narrow pyramidal habit: lvs. oblong-elliptic, usually rusty beneath; fls. somewhat contracted. Blooms early and freely.

16. *Coco*, DC. (*M. pumila*, Andr. *Talauma pumila*, Blume). Shrub, to 12 ft.: lvs. elliptic-oblong, acuminate, glabrous, glaucescent beneath, 3–6 in. long; fls.

axillary, nodding on short-curved pedicels, globose-ovate, white, fragrant, about $1\frac{1}{4}$ in. across; petals 6. China. B.M. 977. G.W. 14, p. 220.—Cult. S.

17. *salicifolia*, Maxim. Slender tree, to 20 ft.: branchlets and buds glabrous; lvs. elliptic-ovate to ovate-lanceolate, acuminate, sometimes bluntly so, broadly cuneate at the base, yellowish green above, glaucescent beneath, glabrous, 3–6 in. long; fls. short-stalked, about 5 in. across, white; sepals lanceolate, greenish white, half as long as petals; petals 6, narrowly oblong-obovate, 2– $2\frac{1}{2}$ in. long; fr. cylindric, $1\frac{1}{2}$ –3 in. long. April. Japan. B.M. 8483. G.C. III. 51:223. G.F. 6:67. S.I.F. 1:40. M.D.G. 1910:542, 543. Gu. 78, p. 196.

18. *Kobus*, Thunb. (*M. Thunbergi*, Hort.). Tree, to 80 ft., with narrow pyramidal head: branchlets glabrous, slender; lvs. broadly obovate, abruptly pointed, tapering toward the base, pubescent below at first, $3\frac{1}{2}$ –6 in. long; fls. 4–5 in. across; sepals very small and narrow; petals 6, spreading, thin, 2– $2\frac{1}{2}$ in. long; fr. slender, dark brown, 4–5 in. long. April, May. Japan. B.M. 8428. G.C. III. 37:264. S.I.F. 1:39. M.D.G. 1902:529. S.T.S. 2:126.—One of the hardiest species but less showy; seems not to flower very profusely. Var. *borealis*, Sarg. Fig. 2299. Larger lvs., fls. and frs. than the type. G.F. 6:66 (adapted in Fig. 2299).

19. *liliflora*, Desrouss. (*M. obovata*, Willd., not Thunb. *M. discolor*, Vent. *M. purpurea*, Curt. *M. denudata*, Schneid., not Desrouss.). Usually large shrub, with stout branches: lvs. obovate or oval-obovate, acute or acuminate, pubescent beneath at first, 4–7 in. long; fls. large, campanulate, white inside, purple outside, scentless; petals broad, obtuse, somewhat fleshy, about $3\frac{1}{2}$ in. long; sepals small, ovate-lanceolate, greenish yellow; fr. brownish, ovate-oblong. May, June. China, Japan. B.M. 390. Gn. 22, p. 485; 24, p. 511; 46, p. 49. F.E. 9:611; 17:528 (pl. 74). Var. *gracilis*, Rehd. (*M. gracilis*, Salisb.). Smaller shrub, with slender branches, narrower lvs. and smaller fls., dark purple outside. Var. *nigra*, Rehd. (*M. Soulangeana* var. *nigra*, Nichols.). Fls. dark purple outside, pink inside (Gn. 25:276).

20. *Soulangeana*, Soul. (*M. denudata* $\times$ *M. liliflora*). Fig. 2300. Intermediate between the parents. Popular



2300. *Magnolia Soulangeana*. ($\times \frac{1}{4}$)

large shrub or small tree: lvs. obovate to obovate-oblong: fls. large, campanulate, white, more or less purplish outside, often fragrant; sepals usually colored, sometimes almost as long, sometimes hardly half as long as petals, rarely small and greenish. May. A.G. 15:283. B.R. 1164. Gn. 59, p. 241; 66, p. 76; 76, p. 135. F.R. 8:3. R.H. 1912, p. 373. F.E. 15:482 (pl. 51). Gt. 5:166 and 168. Var. *Lennéi*, Rehd. Nearer to *M. liliflora*. More shrubby: fls. large, deep crimson outside, late. F. 1864:25. V. 5:196. G. 26:316. G.M. 53:1031. G.L. 24:7. Var. *Niemétzii*, Hort. A fastigate form.

There are many other named varieties, varying in color and flowering-time, as var. *Alexandrina*, Hort., fls. outside toward the base deep purple, white inside, one of the earliest (Gn. M. 5:149. R.B. 26:217. R.H. 1912, p. 370); var. *álba superbá*, Hort., white (G. 33:449); var. *Brozzónii*, Hort., fls. white, shaded purple (G. 34:429, 431); var. *cyathifórmis*, Hort. Rinz., cup-shaped, light purple; var. *grándis*, Hort. Rinz., white, outer petals purple at base and in the middle; var. *Norbertiána*, Hort., white and light purple, one of the latest to bloom; var. *rústica* (*M. rústica fl. rubro*, Hort.), deep purple outside (F.S.R. 1:16. G. 29:201); var. *speciòsa*, Hort., white, striped purple outside; var. *triúmphans*, Hort., pink toward the base outside. These hybrids are among the most popular magnolias on account of their early, bright-colored fls.; they are showier and hardier than the preceding species.

21. *denudàta*, Desrouss. (*M. précia*, Correa. *M. conspicua*, Salisb. *M. Yulan*, Desf.). Fig. 2301. Tree, to 50 ft., with spreading branches: lvs. obovate or obovate-oblong, shortly pointed, pubescent beneath when young, 4-7 in. long: fls. large, campanulate, white, sweet-scented, about 6 in. across; petals and sepals almost alike, 9, concave, fleshy, 3-4 in. long: fr. brownish, 3-4 in. long, slender. April, May. Cent. China. B.M. 1621. L.B.C. 12:1187. G.C. III. 9:591; 36:59. Gn. 21, p. 311; 23, p. 138; 24, p. 511; 31, p. 505; 34:667; 45, p. 365; 46, p. 145; 51, p. 474. G.M. 31:289; 36:386; 44:181. G. 26:47. C.L.A. 3:173. M.D.G. 20:253. G.W. 14, p. 206.—One of the most showy species. Var. *purpuráscens*, Rehd. & Wilson (*M. conspicua* var. *purpuráscens*, Maxim.). Fls. rose-red outside, pale pink within. Var. *elongàta*, Rehd. & Wilson. Lvs. longer and larger: fls. larger, white.

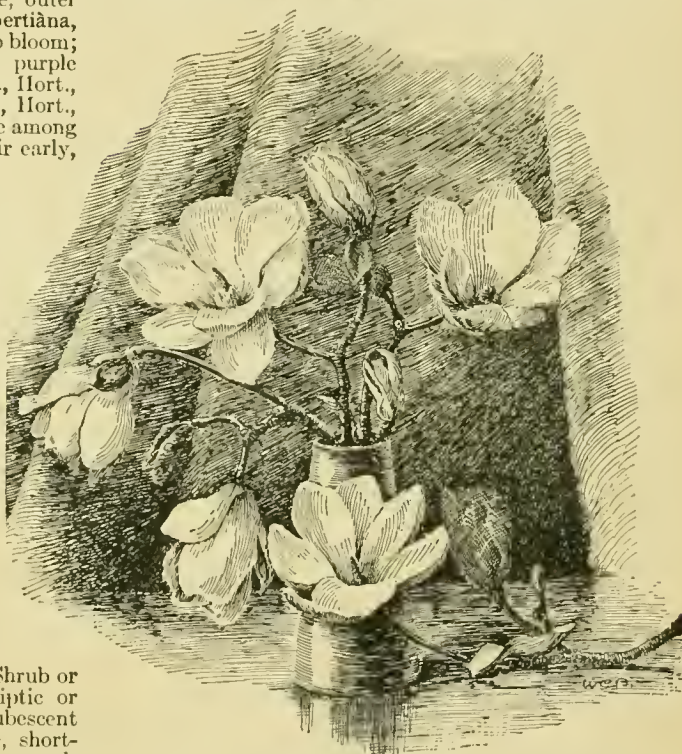
22. *stellàta*, Maxim. (*M. Halleàna*, Hort.). Shrub or small tree, with spreading branches: lvs. elliptic or obovate to oblong-obovate, obtusely pointed, pubescent beneath when young, 2-5 in. long: fls. white, short-stalked, numerous, about 3 in. across, sweet-scented; petals narrow-oblong, 9-18, spreading and afterward reflexed: fr. with only few fertile carpels. March, April. Japan. B.M. 6370. R.H. 1878:270. Gn. 13:572; 61, p. 379; 75, p. 240; 77, p. 145; 78, p. 117. G.F. 9:195. G.C. III. 7:617; 17:521; 39:260, 261. Gng. 2:57. A.F. 6:305. F.E. 9:611; 15, pl. 318, 616 (pl. 53). G.M. 38:489; 44:180; 50:293; 57:769. Gn.M. 3:267; 5:141, 150. Gn.W. 20:15. Gt. 52, p. 409. M.D.G. 1909:289. G.W. 5, p. 113; 14, p. 207. F.M. 1878:309.—Quite hardy and very free-flowering; it begins to flower when hardly 2 ft. high. Var. *ròsea*, Hort. Fls. blushed outside. R.B. 30, p. 85. J.H.S. 27, p. 865. Var. *Keiskei*, Makino. Densely branched shrub: fls. smaller, purple outside. Not yet intro.

23. *Cámpbellii*, Hook. f. & Thoms. Tree, to 80 ft.: lvs. elliptic-oblong or ovate, abruptly acuminate, glaucous beneath and silky pubescent when young, 5-12 in. long: fls. cup-shaped, 6-10 in. across, white and pink inside, shaded with crimson outside; petals obovate, 9-15: fr. greenish brown, 6-8 in. long. May. Himalayas. B.M. 6793. F.S. 12:1282-5. Gn. 48:142; 53, pp. 167,

305. G.C. III. 23:89; 42:4. F.S.R. 2:296. G. 35:175. Gn.W. 23:552. J.H. III. 42:117; 62:145.—Beautiful tree, hardy only S.

M. compréssa, Maxim. = *Michelia compréssa*.—*M. Dawsoniána*, Rehd. & Wilson. Tree, to 35 ft.: lvs. subcoriaceous, obovate, glossy above, glabrous beneath, 3-6 in. long: fr. cylindric, 4 in. long: fls. unknown. W. China.—*M. fuscàta*, Andr. = *Michelia fuscata*.—*M. globòsa*, Hook. f. & Thoms. Allied to *M. parviflora*. Tree, to 40 ft.: lvs. ovate, fulvous-pubescent on the veins beneath, 5-9 in. long: stamens and pistil bright red: fr. oblong, 2 in. long. Himalayas.—*M. officinális*, Rehd. & Wilson. Closely related to *M. hypoleuca*. Branchlets yellowish: lvs. obovate, to 1½ ft. long: stamens shorter: fr. oblong-ovate, 4-5 in. long. Cent. China.—*M. Sargentiana*, Rehd. & Wilson. Tree, to 75 ft.: lvs. subcoriaceous, obovate, glabrous above, pubescent beneath, 4-7½ in. long: fr. cylindric, 4-6 in. long: fls. unknown, said to be rosy red and about 8 in. across. W. China. Var. *robusta*, Rehd. & Wilson. Lvs. oblong-obovate, 6-9 in. long: fr. to 7½ in. long. ALFRED REHDER.

MAGYDÀRIS (old Greek name). *Umbelliferae*. Two perennial herbs of Spain, Sicily and N. W. Afr., one of which is offered abroad as an ornamental plant. Lvs.



2301. *Magnolia denudata*, commonly known as *M. conspicua*.

pinnate or pinnatisect, the segms. large, dentate or cut: fls. white in compound many-rayed umbels, with the many bracts of the involucre and involucels linear or lanceolate; petals obovate and inflexed at the apex and more or less 2-lobed: fr. oblong, tomentose. *M. tomentòsa*, Koch, has lvs. pinnatisect, tomentose beneath, nearly or quite glabrous above: bracts of involucre elongated-linear and undivided: fr. ovate, the carpels very obtuse and tomentose.

MAHERNIA (anagram of *Hermannia*). *Sterculiàceae*. One very fragrant herb-like plant in greenhouses, and perhaps one or two others are cultivated. By some united with *Hermannia*.

Calyx campanulate, 5-creft; petals 5, with hollow claws, twisted in the bud; stamens 5, opposite the petals, the filaments prominently enlarged or dilated at about the middle (and thus differing from *Hermannia*, which has no sudden enlargement in the filaments), the anthers long; ovary 5-loculed, ripening

into a coriaceous caps. with many seeds.—More than 30 herbs and subshrubs of S. Afr., mostly with incised lvs. and drooping, bell-shaped fls.

verticillata, Linn. (*M. odorata*, Hort., not of botanists, which is *Hermania Presliana*). HONEY-BELL. Fig. 2302. A frequent plant in conservatories, and sometimes seen in window-gardens and collections: half woody, very diffuse and straggly, not making a central leader, the terete crooked



2302. *Mahernia verticillata*.
($\times 3\frac{1}{2}$)

sts. scabrous: lvs. small, much cut into linear divisions, with deep-cut stipules: fls. $\frac{3}{4}$ in. or less long, nodding, usually about 2 together, from axillary shoots, sweet, fragrant, honey-yellow.—Free bloomer in winter and spring. Of

easy cult. Prop. by cuttings. A very pretty twiggy bush for the cool greenhouse. The branches are long and flexible, so that specimens may be trained into any form. It may also be used for hanging-baskets. It is of easy cult. in pots, but lifts badly.

glabrata, Cav. Lvs. dentate or dentate-pinnatifid (not so finely cut as in the last), covered with stellate down: trailing, not odorous.—It is doubtful whether the plant cult. under this name is the *M. glabrata* of botanists.

L. H. B.

MAHOE, MOUNTAIN: *Hibiscus elatus*.

MAHOGANY: *Swietenia*. Mountain M.: *Cercocarpus*.

MAHONIA (after Bernard M'Mahon, a prominent American horticulturist; 1775–1816; see Vol. III, p. 1586, for a biographical sketch). Syn., *Odostemon*. *Berberidaceæ*. Ornamental woody plants grown chiefly for their handsome evergreen foliage and for their large panicles of yellow flowers. Usually united with *Berberis*.

Evergreen shrubs, rarely small trees: lvs. alternate, odd-pinnate, rarely 3-foliate, with minute subulate stipules: fls. yellow, in many-fl. racemes or panicles springing from the axils of bud-scales; sepals 9; petals 6 with nectaries at the base; stamens 6; ovary 1-celled with usually few ovules: fr. a dark blue and bloomy, rarely red berry, with usually few small seeds.—About 45 species in N. and Cent. Amer. and E. and S. E. Asia. From *Berberis* with which it is often united, it is easily distinguished by the pinnate lvs. and the unarmed branches, also by the large infl. springing from the axils of bud-scales and by the 9 sepals. Monograph by Fedde in Engler, Bot. Jahrbücher 31:30–133 (1901).

The mahonias are very handsome evergreen shrubs spreading usually by suckers, with large leaves and yellow flowers in conspicuous panicles appearing in spring and followed by dark blue bloomy berries. Most of the species are tender, but *M. repens*, *M. Aquifolium*, *M. nervosa*, *M. pinnata* var. *Wagneri* are hardy as far north as Massachusetts, but the foliage is liable to be scorched if exposed to the winter's sun, though *M. repens* is more resistant and is rarely burned. *M. japonica* will succeed if planted in sheltered situations. *M. pinnata* is a most beautiful evergreen species, but it requires protection from cold winds, and the winter's sun. *M. repens* is the best evergreen species we have. It spreads rapidly and the foliage is rarely burned, and the numerous clusters of showy yellow flowers render it most attractive at the end of May. They prefer a

humid soil and a position sheltered from strong winds and from the hot sun. They are easily transplanted and some, particularly *M. repens* and *M. nervosa*, spread considerably by suckers. Propagation is by seeds sown soon after maturity or stratified and sown in spring, or by suckers which are freely produced in most species, also by cuttings of half-ripened wood under glass and by layers.

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A. Racemes many-fl., usually dense.

B. Lfts. rounded or truncate at the base, rarely cuneate, ovate to ovate-oblong.

C. Texture of lvs. leathery; lfts. 3–9, sometimes 13.

D. Petiole about 1 in. long; lfts. 3–9.

1. *Aquifolium*, Nutt. (*Berberis Aquifolium*, Pursh. *Odostemon nutkanus*, Rydb.). Fig. 2303. From 3–6 ft.: lfts. 5–9, oblong or oblong-ovate, dark green and lustrous above, spinulose-dentate, $1\frac{1}{2}$ –3 in. long: racemes erect, fascicled: berries blue, small. May. Brit. Col. to Ore. B.R. 1425. L.B.C. 18:1718. P.M. 9:5. G. 12:721; 28:143. G.M. 44:659. Gn.W. 23:361. Var. *juglandifolia*, Jouin. Lfts. usually 7, the lowest pair usually close to the base of the petiole, often subcordate at the base, smaller and of thicker texture, teeth smaller, acuminate; rachis usually red. Var. *gracilis*, Jouin (*M. gracilis*, Hort., not Fedde). Lfts. 5–9, oblong-ovate, cuneate at the base, spinose-serrate with small teeth, slightly lustrous above, 2–3 in. long. There are also forms with variegated lvs., with yellow foliage and with the young foliage bright red.

2. *repens*, Don (*Berberis repens*, Lindl. *B. Aquifolium*, Brit. & Brown. *B. nana*, Greene. *Odostemon Aquifolium*, Rydb.). Rarely over 1 ft. high, stoloniferous: lfts. 3–7, roundish ovate or ovate, pale or glaucous and dull above, spinulose-dentate, $1\frac{1}{2}$ –2½ in. long: fls. and fr. as in the preceding. Brit. Col. to Calif. and N. Mex. B.R. 1176. L.B.C. 19:1847.—Hardier than the preceding species, but less handsome.



2303. *Mahonia Aquifolium*. ($\times 3\frac{1}{2}$)

Var. *rotundifolia*, Fedde (*Berberis rotundifolia* Herveyi, Hort.). Lfts. usually 5, broader, often suborbicular, nearly entire or finely and sparingly serrate. Var. *macrocarpa*, Jouin. Frs. thicker and lvs. less opaque.

DD. Petiole usually very short; lfts. 7–13.

3. *pinnata*, Fedde (*Berberis pinnata*, Lag. *M. fascicularis*, DC. *B. Aquifolium* var. *fascicularis*, Bean). Two to 6 ft.: lfts. 7–13, ovate or ovate-lanceolate, undulate at the margin and with few spiny teeth,

grayish green and somewhat lustrous above, 1-2½ in. long: fls. in short, fasciated racemes: fr. blue. Calif., N. Mex. and Mex. B.M. 2396. B.R. 702. Var. *Wagneri*, Jouin. Lfts. 7-11 with 4-5 teeth on each side, dark green above and slightly lustrous, light green beneath. M.D. 1910, p. 89.—This variety is about as hardy as *M. Aquifolium*, but grows taller and is very desirable. Possibly a hybrid with *M. Aquifolium*.

cc. Texture of lvs. rigid; lfts. 9-25.

d. Sts. scarcely exceeding 1 ft.

4. *nervosa*, Nutt. (*Berberis nervosa*, Pursh. *M. glutinosa*, DC.). Dwarf shrub: sts. with long pointed, husk-like bud-scales: lvs. on stalks 1-4 in. long; lfts. 9-19, lance-ovate, remotely spiny-toothed, 3-5-ribbed, pale green, 1-3 in. long: racemes elongated, erect: fr. oblong, blue. Brit. Col. to Calif. B.M. 3949. L.B.C. 18:1701. B.R. 1426. P.M. 7:55.

dd. Sts. 5-12 ft. tall: lvs. very short-stalked.

5. *nepalensis*, DC. (*Berberis nepalensis*, Spreng.). Lfts. 5-25, ovate-oblong, all of nearly equal size, euneate or rounded at the base, sinuately toothed, with few spiny teeth, lustrous above, 2-4 in. long: racemes to 10 in. long. India, chiefly Himalayas. Gn. 63, p. 94. A.G. 18:355.

6. *japonica*, DC. (*Berberis japonica*, Spreng. *B. Bealii*, Fort.). Lfts. 9-13, roundish or ovate, the terminal one larger, usually truncate or subcordate at the base, with large remote spiny teeth, dull or slightly lustrous above, 2-5 in. long: racemes 3-4 in. long, fasciated: fr. bluish black. China, Himalayas, in Japan only cult. B.M. 4846, 4852. Gn. 63, p. 72. F.S. 6:79. Gn.M. 2:19. H.F. 5:168. G. 2:299; 29:341 and J.F. 3:278 (as *B. nepalensis*).—Very effective by its large bold foliage; has proved hardy at the Arnold Arboretum in sheltered positions. Var. *trifurca*, Schneid. (*B. trifurca*, Forbes). Lfts. 4 in. long and 2 in. broad, 3-pointed at the apex and with a few teeth at the base. Var. *gracillima*, Fedde. Lfts. smaller, about 2 in. long and ¾ in. broad.

bb. Lfts. euneate at the base, lanceolate.

7. *Fortunei*, Fedde (*Berberis Fortunei*, Lindl.). Shrub, to 6 ft.: lfts. 5-9, narrow-lanceolate, spinose-serrate with small appressed teeth, 2-5 in. long: racemes erect, fasciated, to 6 in. long. China. F.S. 3:291 b. J.H.S. 1846:300.

aa. Racemes few-fl'd.: lfts. rigid, 3-7.

8. *Fremontii*, Fedde (*Berberis Fremontii*, Torr.). Fig. 2304. Shrub, 5-12 ft.: lfts. 3-7, ovate or oblong, with few strong, spiny teeth, blue-green, dull, ½-1 in. long: racemes loose, 3-7-fl'd.; pedicels slender: fr. at least ½ in. across, inflated and rather dry, blue. W. Texas to Utah, Ariz. and Calif. G.F. 1:497 (adapted in Fig. 2304).

M. arguta, Hutchins. (*Berberis Hutchinsonii*, Rehd. *B. arguta*, Ball, not Schneid.). Shrub, to 5 ft.: lfts. 9-11, lanceolate, entire or with few teeth: fls. in peduncled racemes, 12-16 in. long. Probably from Cent. Amer. B.M. 8266. Ga. 72, p. 481.—*M. brevipes*, Rehd. (*Berberis brevipes*, Greene). Allied to *B. repens*, but much smaller in every part: lvs. short-petioled; lfts. usually 7, broadly elliptic-oblong, 1-1½ in. long: racemes short, few-fl'd. Alberta.—*M. arctica*, Fedde (*Berberis gracilis*, Hartw.). Allied to *B. pinnata*. Lfts. ovate to lanceolate, finely serrate or entire, 1-2 in. long, lustrous. Mex., Texas.—*M. hamatocarpa*, Fedde (*Berberis hamatocarpa*, Wootton). Very similar to *B. Fremontii*, but the terminal lft. longer than the lanceolate lateral ones: fr. red. Colo. and New Mex.—*M. heterophylla*, Schneid. (*B. heterophylla*, Zabel, not Juss. *B. tolucaeensis*, Hort.). Possibly *M. Aquifolium* × *M. Fortunei*. Lvs. long-petioled; lfts. 5-7, lanceolate, 1½-3½ in. long, ½-1 in. broad, spiny-toothed, lustrous. Of unknown origin.—*M. pallida*, Fedde (*Berberis pallida*, Beuth.). Lfts. 9-13, ovate to ovate-lanceolate, 2-3½ in. long, spinose, dark green above, grayish beneath: racemes compound, loose. Mex. R.B. 30:16.—*M. pumila*, Fedde (*Berberis pumila*, Greene). Allied to *M. repens*. A foot high or less: sts. upright, rigid, not sarmentose: lfts. 1-5, thick, ovate to round-ovate, coarsely spiny-toothed, reticulate: racemes short: berries smaller, very glaucous. Calif., Coast Range.—*M. tenuifolia*, Fedde (*Berberis tenuifolia*, Lindl.). Lfts. 3-7, lanceolate, entire: racemes nodding, very long and loose.

Mex. B.R. 30:26.—*M. trifoliolata*, Fedde (*Berberis trifoliolata*, Moric. *B. trifoliata*, Hartw.). Allied to *B. Fremontii*. Lfts. 3, sessile, rigid, pale; coarsely spiny-toothed: racemes short, few-fl'd. Texas to Mex. B.R. 31:10. F.S. 1:56.—*M. Wilcoxii*, Rehd. (*B. Wilcoxii*, Kearny, *Odoestemon Wilcoxii*, Heller). Allied to *M. Aquifolium*, but lfts. smaller, very coriaceous, oval or ovate with only 3-5 spreading spiny teeth on each side. Ariz.

ALFRED REHDER.

MAIANTHEMUM (Greek, *Mayflower*). Syn. *Unifolium*. *Liliaceae*. Small spring-blooming woody perennials, good for colonizing.

Convallaria-like, with slender rootstocks and 1-3-lyd. sts. that are 3-8 in. or more high and bear a few white 4-parted small fls. in a raceme; segms. separate or practically so, spreading or reflexed, deciduous; stamens 4, inserted at base of segms; ovary 1; style 1, 2-lobed: fr. a globular 2-celled and 1-2-seeded berry.—Species 2 (by some considered only 1), in the cool parts

of northern hemisphere. They make interesting mats or colonies in shady places. *M. canadense*, Desf. (*Unifolium canadense*, Greene), native in moist cool woods from Newfoundland to N. C. and west, usually has 2 (1-3) ovate or ovate-lanceolate sessile or very short-petioled lvs. on the st. and many radical lvs. in the spreading colony, cordate at base with narrow sinus: raceme 1-2 in. long, usually many-fl'd., rather dense; fls. white, the



2304. *Mahonia Fremontii*. (× ½)

segms. longer than the stamens: berry pale red, speckled: foliage dies in summer. *M. bifolium*, DC. (*M. Convallaria*, Web.) is the European and Asiatic species: lvs. 2, stalked, triangular-cordate: st. 6-8 in. high from a filiform root: raceme spike-like. Var. *kamtschaticum*, Jepson, Calif. to Alaska and Siberia, is 4-14 in. high, often stout: lvs. ovate or triangular-cordate, the petiole of the lower one sometimes longer than the blade, the radical lf. very long-petioled and almost as tall as fl.-st.

L. H. B.

MAIDENHAIR FERN: *Adiantum*.

MAIDENHAIR TREE: *Ginkgo*.

MAIZE: *Corn* and *Zea*.

MAKART DECORATIONS and bouquets are dried grasses and everlasting, whether dyed or not. The celebrated painter, Hans Makart, once decorated his salon with dried palm leaves, pampas grass and the like, to the delight of the Emperor of Austria, who visited the artist's studio; hence the name. See *Everlastings* and G.C. III. 6:714.

MALACOCARPUS (Greek, *soft* and *fruit*). *Cactaceae*. A genus commonly combined with *Echinocactus*. As usually understood, it consists of globose plants: fls. slightly funnel-shape, usually yellow; ovary with scales bearing in their axils bristles and wool; stigmalobes red: fr. soft, rose-colored or crimson. Six species have been assigned to this genus; but if it is to be retained, more species are doubtless to be referred to it. It is native of the east coast of S. Amer. *M. Sellowii*, Schum., is offered in the European trade under the name of *Echinocactus Sellowii*.

J. N. ROSE.

MALACOTHRIX (Greek words, meaning *soft hair*). *Compositæ*. Annual and perennial herbs of W. N. Amer., one of which is listed; species probably 20: leafy-stemmed or scapose, usually with a radical cluster of lvs.: heads yellow, white or pinkish, peduncled, usually nodding in bud; receptacle naked or bristly; fls. all ligulate, hermaphrodite: achene short, terete, ribbed, with soft pappus-bristles. *M. californica*, DC. Annual, acaulescent, bearing single rather large light yellow heads on scapes 4-6 in. high: lvs. prominently woolly when young, pinnatifid, the lobes linear to almost filiform: involucre-bracts narrow-linear or subulate, in about 3 series. Sandy soils, Calif.

L. H. B.

MALAY APPLE: *Eugenia Jambos*.

MALCÔMIA (Wm. Malcolm, English horticulturist of the eighteenth century). Also written *Malcolmia*, but it was originally spelled *Malcomia*. *Cruciferae*. Flower-garden annuals.

Malcomia is a genus of branching herbs, the branches often prostrate: lvs. alternate, entire or pinnatifid: fls. white, purplish or reddish, in a loose raceme; petals long and linear or long-clawed: pods rather terete, long or awl-shaped; seeds in 1 series or in 2 series at the base of the cells, not marginate.—Species about 30, Medit. region.

maritima, R. Br. VIRGINIAN STOCK. MAHON STOCK. Figs. 2305, 2306. St. erect, branching: lvs. elliptic, obtuse, entire, narrowed at the base, pubescence appressed, 2-4-parted: pedicels rather shorter than the calyx; fls. shades of lilac and red to white, the limb veined: pods pubescent, long-acuminate at the apex. Medit. region. B.M. 166 (as *Cheiranthus maritimus*, showing red fls., changing to purple before fading). J.H. III. 59:30.—It is a charming hardy annual of the easiest cult. growing about a foot high, with a more branching and open habit than the common stock (*Matthiola*), and 4-petaled fls. each about $\frac{3}{4}$ in. across. Red, white and crimson-fl. kinds are offered in Amer., while rose and lilac fls. appear in the mixtures. There seem to be no double forms. It is an excellent plant for the front of a border, as it may be easily had in

economic products, but very little known as horticultural subjects.

Leaves alternate or in a few species opposite, broad, simple, palmately nerved: fls. dioecious, small, in spikes or panicles; calyx valvate or imbricate; no petals, disk or rudiment of ovary in the staminate fls.; stamens numerous, anther-cells oblong; the 3 styles almost free at base, elongated; ovules 1 in each cell: caps. separating into 2-3 parts.—About 80-90 species in the Old World tropics. Related to *Mercurialis* and *Macaranga*.

japonicus, Muell. Arg. (*Rottlera japonica*, Spreng.). A small, rather scurly tree with large, ovate, alternate, glabrous or glandular, subtrilobed, reddish lvs.: spikes branched, terminal; fls. 2-3 lines wide; stamens 60-70; caps. $\frac{1}{2}$ in. diam., pubescent with weak prickles. Japan and China. R.H. 1894, p. 103.

philippinensis, Muell. Arg. MONKEY-FACE TREE. KAMILA TREE. Lvs. broadly ovate, rough, entire or nearly so, alternate: caps. not prickly but covered with red-brown glands which furnish the kamila (or kanala) dye of commerce, used in dyeing silks. India to Austral.

J. B. S. NOITON.



2306. *Malcomia maritima*. ($\times \frac{1}{4}$)

MALLOW: *Malva rotundifolia*, and other species.

MALLOW, FALSE: *Malvastrum*.

MALÔPE (name used by Pliny for some kind of mallow). *Malvaceæ*. Flower-garden annuals.

Glabrous or pilose herbs, with entire or 3-parted alternate lvs., and peduncled often showy violet or pink or white axillary fls. subtended by 3 large cordate distinct bracts: calyx 5-parted; column of stamens divided at the top into many filaments: carpels numerous, 1-seeded, congested into a head, indehiscent.—About a dozen species have been described, probably reducible to 3, in the Medit. region. They are of simple cult. in any ordinary garden soil; sow early.

trifida, Cav. Fig. 2307. Plant 2-3 ft. high, bearing rose and purple fls. 2-3 in. across, the center usually darker, blooming most of the summer: lvs. 3-nerved, 3-lobed, dentate, glabrous; lobes acuminate: peduncles axillary, 1-fl. Spain, N. Afr. Gn.W. 25:584. H.U. 2:166. Var. *grandiflora*, Paxt. (*M. grandiflora*, F. G. Dietr.), is said to be superior to the type, with fls. large, deep rosy red, veined inside darker. Gn. 21, p. 145. P.M. 1:177. G.W. 15, p. 215. Var. *alba*, Hort., has white fls. Var. *rosea*, Hort., has rose-colored fls. G. 27:563. Seeds are offered separately in white, rose and red.

malacoides, Linn. An old garden annual, but apparently not now cult. to any extent: 1-3 ft.: lvs. oblong-ovate to lanceolate, crenate or pinnatifid, tapering or cordate at base: fls. large, purple-violet, solitary. Var. *rosea*, Hort., has rose-red fls. S. Eu., Asia Minor.

L. H. B.

MALORTIEA (E. von Malortie, Germany). *Palmae*. A small group of diminutive palms of Cent. Amer., by some authorities referred to *Reinhardtia* as a subgenus, with 6-12 stamens. They are spineless plants, with alternate lvs. which are simple or 2-lobed at the end, margins entire or dentate or crose on the ends: fls. unisexual, in branched spadices or spikes that arise



2305. *Malcomia maritima*.—Virginian stock, Crimson King.

bloom from spring to fall by means of successional sowings. Seeds are best sown in the fall, as they give earlier bloom. Seeds may be sown thinly.

M. bicolor, Boiss. & Heldr. Low, about 6 in., pubescent: lvs. oblong-lanceolate to ovate, nearly entire: fls. pink, yellowish at base. Mountains, Greece. Gt. 1:226.—*M. littorea*, R. Br. Six to 12 in. lvs. hoary, lance-linear, nearly entire: fls. large, pink-purple, the spreading limb not prominently veined. W. Medit. region.

WILHELM MILLER.

L. H. B.†

MALLÔTUS (Greek, *woolly*, from the long white spines on the fruit of some species). *Euphorbiaceæ*. Trees or shrubs, some rarely cultivated for their

from the lower axils. They are warmhouse subjects, and useful where very small palms are desired, as in a Wardian case.

M. gracilis, Wendl. Sts. slender, ringed, 18–24 in. or more high: lvs. slender-petioled, about 9 in. long and broad, split to the rachis at the top, and the 2 halves lobed, the lobes entire or notched,

split near the rachis to form holes: spadix erect, branched, bearing scattered sessile male and female fls.; stamens 10–12. Guatemala. B.M. 5291.

M. simplex, Wendl. Slender espitose little palm, with oval slender petioled mostly simple lvs. which are acuminate-toothed and more or less shallow-notched at the apex: spadix few-branched, with sessile fls. Costa Rica. B. M. 5247.—*M. Tuérckheimii*, Damm. Height about 16 in., the sts. thin and about 1½ lines thick and bearing a crown of about 15 geonoma-like dull green lvs.: lf-blade cuneiform, 6 in. long and 2 in. broad, not bifid, with 19 veins either side of midrib and the blade somewhat folded between them, the margin erenulate; petiole about 1 in. long. Guatemala, 4,500 ft. altitude. G. W. 12, p. 99.—Recent.

L. H. B.

MALPÍGHIA
(Marcello Malpighi, 1628–1693, distinguished naturalist at Bologna, who wrote on the anatomy of plants). *Malpighiaceæ*. Trees and shrubs, sometimes grown under glass for ornament, but known mostly from the Barbados cherry, cultivated in the American tropics.

Leaves opposite, short-stalked, glabrous or tomentose, entire or spiny-toothed: fls. axillary and terminal, clustered or corymbose, rarely solitary, red, rose or white; calyx with a pair of thick glands on the back of some or all the 5 sepals; stamens 10, all perfect, the base of filaments glabrous; ovary 3-celled; styles 3, distinct: drupe 3-pyrenous, not winged, the stones with 3–5 crests or wings on the back.—Species 30–40 in Trop. Amer., extending as far north as S. Texas. Small describes 29 species in N. Amer. Fl. XXV, p. 152 (1910).

glabra, Linn. BARBADOS CHERRY. Fig. 2308. Shrub, 6 ft., glabrous, the branches slender: lvs. ovate to elliptic, entire, usually pointed, having a few bispinulate hairs which disappear early: umbels 3–5-fld.; fls. ¾ in. across, rose-red, the petals crose or fringed: drupes red or scarlet, about the size of a cherry, acid, with thin skin, used for jam and preserves; seeds large, 4-angled. S. Texas to N. S. Amer.; W. Indies. B.M. 813. —Widely planted in tropics, and offered in S. Fla. Prop. by cuttings, and seeds germinate readily.

mexicana, Juss. (*M. guadalupensis*, Rose). Lvs. ovate to obovate-lanceolate, either acute or obtuse, pubescent or tomentose: cymes one-third to one-half length of lvs.; fls. purplish, about ¾ in. across; sepals ovate to ovate-lanceolate, densely pubescent: fr. nearly globose, red. Mex.—Offered in S. Calif.

coccigera, Linn. Lvs. oval or ovate to suborbicular, obtuse, rounded or emarginate, mostly sinuate-dentate, glabrous at maturity, shining above: cymes short-peduncled; fls. pink; sepals oblong or ovate-oblong,

with large glands: drupe nearly globose, red. W. Indies. —Listed in S. Fla. as a good holly-like plant useful for dwarf hedging.

L. H. B.

MALUS (Greek for apple). *Rosaceæ*. APPLE. Most botanists prefer to unite the apple and pear in the one genus *Pyrus*; this is the method of Bentham & Hooker in "Genera Plantarum," and of Focke in Engler & Prantl's "Pflanzenfamilien," although the recent excellent work of Schneider, "Handbuch der Laubholzkunde," keeps them distinct, as do some of the recent American authors. The evident botanical distinctions between the two groups are slight, apparently not sufficient for easy or clear determination by the unprofessional student. These differences lie in the usual presence of grit-cells in the fruits of *Pyrus* and their usual absence in *Malus*; in the hypanthium of the former being nearly closed by a cushion, and in the latter free or open; in the cavity about the stem of the fruit in *Malus*, a contrast which does not hold in *Pyrus*; and in the styles of *Pyrus* being distinct or nearly distinct, whereas in *Malus* they are more or less united. The different degrees of union of the styles has been made a basis for distinguishing the named varieties of apples among themselves, and the character does not appear to be important enough to be made the basis of generic separation. It is not impossible that the pears and apples may have had a different phylogenetic origin, but this fact itself would not be sufficient in generic description.—The apples are small trees and bushes, of some fifteen to twenty species in the North Temperate Zone. In this Cyclopaedia, the cultivated apple species are described under *Pyrus*; the names of the leading species under *Malus* are as follows:

M. sylvestris, Mill. = *Pyrus Malus*.

M. prunifolia, Borkh. = *P. prunifolia*.

M. baccata, Borkh. = *P. baccata*.

M. coronaria, Mill. = *P. coronaria*.

M. ioensis, Brit. = *P. ioensis*.

M. Soulardii, Brit. = *P. Soulardii*.

M. angustifolia, Michx. = *P. angustifolia*.

M. Halliana, Koehne = *P. Halliana*.

L. H. B.



2308. *Malpighia glabra*—Barbados cherry. ($\times 2\frac{1}{2}$)

MÁLVA (old Latin name from Greek, referring to the emollient lvs.). *Malvaceæ*. Various annual, biennial and perennial herbs, of considerable use in ornamental plantings.

From numerous allied genera, *Malva* is distinguished by the carpels in a single whorl: ovules solitary, ascend-

ing; bractlets 3, distinct; carpels not beaked or appendaged within. They are hirsute or nearly glabrous plants: lvs. angled, lobed or dissected; fls. solitary in the axils, or clustered, sessile or peduncled; petals 5, notched at the apex.—Species in the neighborhood of 30, in Eu., N. Afr., Asia; several are naturalized in N. Amer.—Few of the mallows are generally in the trade. The most common one is *M. moschata*, although *M. crispa* is frequently seen in gardens for its tall striking growth. They require no special cultural treatment. The genus has been more closely defined in recent time, and some

mm. *Fr. prominently wrinkled-veiny.*
syvestris, Linn. Biennial (perhaps sometimes annual or perennial), 2-3 ft. high, rough-hairy, branching; lvs. rather sharply 5-7-lobed: fls. purple-rose, large; petals 3 times length of calyx. Eu., Temp. Asia, way-sides N. Amer. A.G. 13:471. Var. *mauritiana*, Mill. (*M. mauritiana*, Linn.), has long been cult. in cottage gardens abroad as the **TREE MALLOW**. It is taller, smoother and has more obtuse lobes. Var. *zebrina*, Hort. (*M. zebrina*, Hort.), has variable fls., usually white striped with purple.

AA. Fls. small and inconspicuous, whitish;

u. Lvs. not curled at the margins.

rotundifolia, Linn. Fig. 2310. **COMMON MALLOW**. Sts. trailing from a strong, deep root: lvs. rounded kidney-shaped, crenate; li.-stalks very long; peduncles rather slender.—Common biennial or perennial weed, not cult.: intro. from Eu. and now common in barn-yards and waste places. The flat wrinkled fruits are known to children as "cheeses." Also locally called "shirt-button plant."

BB. Lvs. curled or puckered at the margin.

crispa, Linn. **CURLED MALLOW**. Fig. 2311. Unbranched annual, 4-8 ft. high, leafy from base to top: lvs. rounded, 5-7-lobed or -angled, attractively crisped and curled; fls. clustered, almost sessile. Eu.; sparingly escaped from old gardens. Gn. 2, p. 315.—The elegantly crisped lvs. are sometimes used for garnishing dishes. Generally self-sows in gardens. It provides a stately subject where stiff straight forms are desired; the sts. sometimes attain a thickness of 3 in. at the base.

M. campanulata, Paxt. = *Malvastrum*.—*M. capensis*, Linn. = *Malvastrum*.—*M. coccinea*, Nutt. = *Malvastrum*.—*M. involucreta*, Torr. & Gray = *Callirhoe*.—*M. lateritia*, Hook. = *Malvastrum*.—*M. minima*, Cav. = *Spharalcea*.—*M. Papaver*, Cav. = *Callirhoe*.—*M. pedata*, Torr. & Gray = *Callirhoe*.—*M. umbellata*, Cav. = *Spharalcea*.

WILHELM MILLER.
L. H. B.†

MALVÁSTRUM (name made from *Malva*). *Malvaceæ*. **FALSE MALLOW**. Mallow-like herbs grown with perennials.

From *Malva* and its allies it differs in having short or capitate stigmas on the style-branches rather than longitudinal stigmas, and a single whorl of carpels. From *Malvaviscus* it differs in having a dry rather than a baccate fr., and in other characters. Herbs and undershrubs of differing habit, sometimes low and diffuse and sometimes tall: lvs. various, entire, cordate or lobed; fls. scarlet, orange or yellow,

short-peduncled or nearly sessile, axillary or in terminal spikes; calyx-like involucrel wanting or of 2 or 3 bracts; calyx 5-cleft; petals emarginate or entire; styles 5 or more; carpels few to many, 1-ovuled, nearly or quite indehiscent and falling away



2309. *Malva moschata*. ($\times \frac{2}{3}$)

of the plants that belong in *Callirhoe*, *Malvastrum*, and *Spharalcea* are still likely to be listed under *Malva*.

A. Fls. large and showy, $1\frac{1}{2}$ -2 in. across.

B. Fr. downy, not wrinkled.

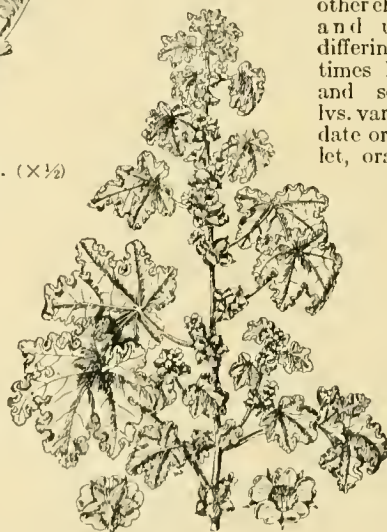
moschata, Linn. **MUSK MALLOW**. Fig. 2309. Perennial, 1-2 ft. high, with simple pubescence: st.-lvs. 5-parted and the parts 1-2-parted or cleft, the lobes being linear (lf.-formation variable); fls. rose or white; calyx with long, simple hairs. Eu.; cult. and escaped. R.H. 1851: 381.—A good old garden subject, with fls. varying in color shades, and run wild in grass along roadsides. The white-fl. garden form is often listed as var. *alba*.

BB. Fr. glabrous, minutely wrinkled or veiny.

Álcea, Linn. Much like *M. moschata*, but st.-lvs. only once 5-parted or 5-cleft, with incised or toothed lobes: fls. deep rose to white; calyx densely stellate-pubescent. Eu.; cult. and escaped. B.M. 2297. Gn.W. 4:745. (pink, veined deeper). Var. *fastigiata*, Koch (*M. fastigiata*, Cav. *M. Morenii*, Pollini). Lvs. less incised; upper st.-lvs. 3-fid; intermediate ones 5-fid; lobes oblong, unequally dentate. B.M. 2793. Gn. 75, p. 432.



2310. *Malva rotundifolia*. ($\times \frac{1}{2}$)



2311. *Malva crispa*. ($\times \frac{1}{2}$)

from the axis at maturity.—Some 70–80 or more species, in Amer. and S. Afr. The garden species are perennials of easy cult., blooming in the hot weather.

A. *Fls. white, with eye.*

hypomadârum, Sprague. Shrubby, sometimes reaching 10 ft., slender-branched, free-flowering: lvs. variable, usually 3-lobed and more or less toothed, sparsely soft-hairy on both sides: fls. white with rose-purple eye, about $1\frac{1}{2}$ in. across, axillary, solitary or 2 or 3 together; petals obliquely obovate, retuse; calyx-lobes ovate, acuminate and ciliate; bractlets 3, spatulate-linear, ciliate. S. Afr. G.C. III. 43:394; 44:92. B.R. 295 (as *Malva capensis*).—This species was founded as late as 1908, although in cult. in Great Britain for a century under other names, as *M. capense*, *M. virgatum*, *M. grossulariaefolium*. Prop. by cuttings under glass in late spring, giving bloom in a cool greenhouse the following season.

AA. *Fls. colored.*

capense, Garcke (*Málva capensis*, Linn.). Shrubby and branchy, slightly viscid: lvs. ovate-oblong, somewhat 3-lobed and angled, unequally toothed: fls. 1–2 on axillary peduncles, purple; involucrel variable in size, the bracts lanceolate to ovate-lanceolate and shorter than the ciliate calyx-lobes; carpels glabrous. S. Afr.—Offered abroad and also in S. Calif. Var. **Lindemuthii**, Hort., said to be a graft-variety procured by working *M. capense* on *Abutilon Thompsonii*: lvs. 3-lobed, yellow-variegated: fls. small, rose-red shaded violet. See also *Kitaibelia Lindemuthii*, p. 1738. It is doubtful whether *M. capense* is in cult.; the plants passing under this name may be *M. hypomadârum*.

lateritium, Nichols. (*Málva lateritia*, Hook.). Prostrate, hirsute, 6 in.: lvs. 3–5-lobed, truncate at base, the lobes cuneate to broad-oblong: fls. long-peduncled, solitary, brick-red; calyx-lobes ovate and spreading; involucrel of 3 ovate bracts; petals round-cuneate, yellow at the base. S. Amer. B.M. 3846.—*Malva lateritia* is offered in England where the root is said to be hardy in ordinary winters, producing “very pretty peach-colored” fls. Useful for covering dry banks in the sun.

coccineum, Gray (*Málva coccinea*, Nutt. *Cristaria coccinea*, Pursh). A tufted canescent plant, 4–18 in. high, with running rootstocks: lvs. 1–2 in. across, pedately 3–5-parted or -divided, the narrow divisions again cut or cleft: fls. brick-red or coppery, in a short terminal raceme: carpels round-kidney-shaped, inclosed in the incurving calyx-lobes, 10–15, reticulated, indehiscent, 1- or 2-seeded. Neb. to Manitoba and west. B.M. 1673. Var. **grandiflorum**, Hort., has large deep scarlet fls.

campanulâtum, Nichols. (*Málva campanulâta*, Paxt. *Málva purpurâta*, Lindl.). Two ft. or less high, hairy: lvs. pedately 3–7-lobed, the lobes deeply cut and toothed: fls. rose-purple, an inch across, in a loose terminal raceme, blooming until killed by frost; bractlets very narrow. Chile. B.M. 3814. B.R. 1362. G.C. III. 48:179; 52:193. P.M. 9:173, and R.H. 1843:325.

M. Gilliesii, Baker. More or less procumbent: lvs. hairy, palmately divided: fls. 1 in. or more across, bright red. S. Amer.—*M. splendendum*, once listed, is probably *M. Thunbergii* var. *laxiflorum*, Gray (*M. splendendum*, Kell.), in S. Utah to S. Calif. Shrub, becoming 12 ft. or more, gray-tomentose: lvs. roundish and mostly subcordate, 3-cleft or obscurely 3–5-lobed: fls. rosy pink, fragrant, rather loosely panicleate.

L. II. B.

MALVAVÍSCUS (Greek, *sticky mallow*). *Malvaceæ*. Shrubs and tall herbs, a very few of which are cultivated for ornament.

Usually hispid: lvs. alternate, entire, dentate, angled or lobed: fls. red, usually on axillary peduncles; petals erect and connivent or spreading in the upper half; column of stamens long and slender, exserted, only partially fertile: carpels fleshy outside, connate into a berry, later becoming dry and separating: involucrel of

7–12 narrow bractlets.—Species 10 or 12, sometimes tree-like, in Trop. Amer., one reaching S. U. S. There is one species of gardens, *M. arboreus*, known to the trade as *Achania Malvariscus*. It is a fine old greenhouse shrub with erect scarlet fls., which resemble an abutilon and never open widely. (Abutilon, however, has no involucre.)

The old *Malvariscus arboreus* is one of the most satisfactory house-plants. It is not subject to insects of any kind, will stand a low temperature in winter, and blooms both winter and summer. When pot-grown, the plant is usually about 2 feet high, but outdoors it makes a strong branching growth, attaining 3 to 5 feet. The bright scarlet flowers remain a long time in perfect condition. The flowers open slightly at the top or not at all. This circumstance gave rise to the old name



2312. *Malvaviscus arboreus*. ($\times \frac{3}{4}$)

Achania, which means “not gaping.” The plant needs a good light soil and thrives in a compost of fibrous peat and loam. Propagated by cuttings. The cultivator need not fear the appearance of white grains on the surface of the leaves, as they are a normal waxy secretion of the plant. (James Vick.)

arboreus, Cav. (*Achania Malvariscus*, Swartz). Fig. 2312. Tall shrub: lvs. alternate, mostly 3-lobed, acuminate, heart-shaped at the base, toothed: fls. convolute in the bud, scarlet, never fully expanding; bractlets erect and narrow. S. Amer. B.M. 2305. L.B.C. 12:1155.—Cult. outdoors in S. Fla. and S. Calif.

móllis, DC. (*Achania móllis*, Ait.). Shrub, recommended for hedges in Calif.: lvs. cordate, soft and tomentose, obscurely 3-lobed: fls. scarlet, with somewhat spreading bracts. Mex. to Colombia. B.M. 2374.

Drummondii, Torr. & Gray. Tall perennial, to 6 ft. or more, somewhat tomentose, erect, simple or branched: lvs. round-cordate, mostly 3-lobed, as broad as long: fls. vermilion-red, 1 in. long, on axillary peduncles; bractlets of involucrel narrow-spatulate; column of stamens becoming exserted: fr. berry-like, red, finally separable into carpels. Fla. to Tex. and S.—A good sun-loving plant.

L. H. B.

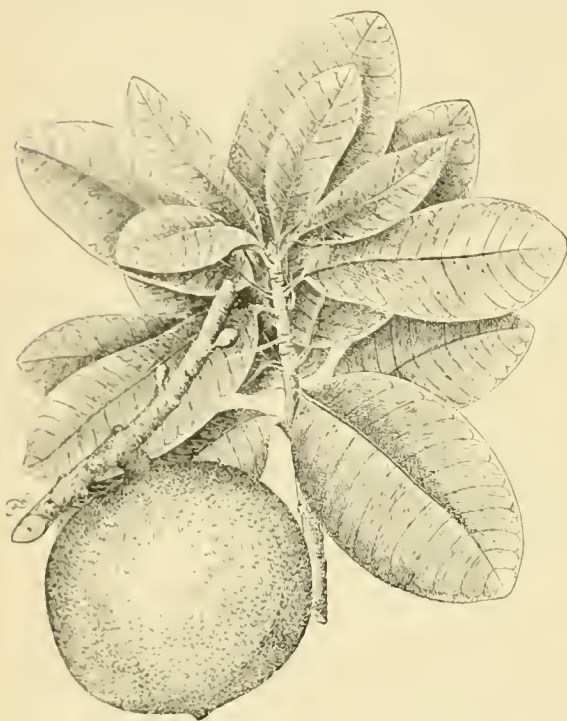
MAMMÈA (from *mamey*, aboriginal West Indian name of *M. americana*). *Guttiferae*. A very small group of tropical trees, of which *M. americana* is the only species of horticultural value. The genus is allied to the Malayan mangosteen (*Garcinia Mangostana*), but differs in its two-parted valvate calyx, closed before anthesis.

Mammea is characterized by rigid, coriaceous lvs., frequently pellucid-punctate; peduncles axillary, 1-fld., solitary or clustered; fls. polygamous; petals 4–6; stamens numerous; stigma peltate or broadly lobed; ovary 2–4-celled: fr. a drupe.—Species perhaps a half-dozen in the tropics of Amer. and Afr. but sometimes defined to include only one.

americana, Linn. MAMMEE-APPLE. SANTO DOMINGO APRICOT. MAMEY. MAMEY DE SANTO DOMINGO. ABRICÓ DE PARÁ. Fig. 2313. A large tree, 40–60 ft. or more in height, of upright, compact growth: lvs. oblong-obovate, entire, 4–8 in. long, 2–4 in. broad,

rounded or blunt at the apex, coriaceous, deep green, glossy on the upper surface, marked with numerous fine transverse, reticulated veins and pellucid dots; petiole stout, $\frac{1}{2}$ in. or less in length; fls. solitary or clustered in the axils of the young shoots; petals white, fragrant; anthers oblong, laterally dehiscent; fr. globose, 3–6 in. diam., russet, seeds 1–4. A native of the W. Indies and N. S. Amer.

When grown on deep rich soils, the mammee-apple attains large proportions, and is one of the most beautiful and conspicuous trees in the West Indies. Its



2313. *Mammea americana*.—Mammee-apple. ($\times \frac{1}{2}$)

trunk sometimes attains a diameter of 3 or 4 feet, while its dense, erect but very broad crown is of a deeper, richer shade of green than that of most other trees. The large, oblong leaves appear as if varnished. The tree is cultivated for its fruit in the West Indies as well as on the mainland of tropical America. It is successfully grown in Florida as far north as Palm Beach, and though not common, fine specimens are occasionally seen at Miami and other points. While young it is very susceptible to frost. It has never been successfully grown in the open in California, so far as known, and is probably too tender for any section of that state.

The fruit is oblate to round in form, commonly 4 to 6 inches in diameter, the surface russet-colored and somewhat rough. The pliable leathery skin is $\frac{1}{4}$ inch in thickness; if cut when green, a bright yellow mucilaginous sap exudes. Surrounding the one to four large, oval, rough seeds is the bright yellow flesh, juicy but of firm texture. The flavor is frequently compared to that of the apricot, and when the fruit is stewed or preserved the resemblance is rather striking. The pulp is sometimes sliced and served with wine, or sugar and cream, but is usually preferred by Europeans in the form of sauce, preserves or jam. The season of ripening in the West Indies is in the summer.

From the fragrant white flowers a liqueur is distilled in the French West Indies which is known as eau de crôle or crème de crôle. The wood is hard and durable, and is said to be well adapted to building pur-

poses as well as cabinet-work; it is beautifully grained and takes a high polish. The resinous gum obtained from the bark is used to extract elichigos from the feet.

Propagation is usually by seeds, which germinate readily if planted in light sandy loam. While the tree prefers a rich well-drained soil, it succeeds remarkably well on the shallow sandy soil, underlaid with soft limestone, of the Florida east coast. Seedlings exhibit considerable variation, and do not, as a rule, come into bearing under six or seven years of age. Some asexual method should be utilized to propagate desirable varieties; inarching succeeds with the mangosteen, and should be applicable to this plant as well; budding might also be successful, performed as with the mango. Through selection of seedlings the fruit could be greatly improved; as an example, a seedling is known in the Isle of Pines in which the flesh separates readily from the seeds, although it normally adheres very closely.

F. W. POPENOE.

MAMMILLARIA (Latin, *mammilla*; referring to the nipple-like tubercles on these plants). Often but not originally spelled *Mamillaria*. *Cactaceæ*. Globular or condensed small spiny cacti grown in greenhouses and some of the species in the open far South; mostly fanciers' plants.

Stems simple, branching or in a cluster from the root, commonly hemispherical or short-cylindrical, but often depressed or sometimes much elongated, the surface entirely broken up into tubercles (*mamillæ*): fls. usually short-funneliform, with naked or nearly naked tube and ovary, borne in the more or less woolly axils between the tubercles, or at the inner extremity of a narrow groove on their upper surface: fr. globose to linear-clavate, nearly always smooth and berry-like. The name *Mammillaria* is one of the generic names conserved by the Vienna rules of nomenclature, but there seems to be no justification for this except as a matter of convenience. The name *Mammillaria*, used for a cactus genus, was given by Haworth in 1812, but is antedated by the *Mammillaria* published by Stackhouse for a genus of alga. The alga name has long been reduced to synonymy, but a recent study of its status seems to justify its reestablishment. *Mammillaria*, as considered here, follows closely the treatment in *Cyclo. Amer. Hort.*, but, as a matter of fact, it would be better to divide the group into 2 or more genera. Britton & Rose are preparing a monograph of the *Cactaceæ* in which these points will be discussed; but in the meantime, the old name *Mammillaria* will be retained.

The cultivation of *Mammillaria* differs in no respect from *Echinocactus*, which see.

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smooth, rather short and stout; radials 10-12; central 1: fls. even larger than in *M. similis*. Texas.

DD. Color of fls. rose.

6. *tuberculosa*, Engelm. (*M. strobiliformis*, Scheer). Ovate or cylindric, rather slender, somewhat dry of texture, the spines falling from the older tubercles, leaving them as dry, corky protuberances: tubercles short-ovate from a broad base; axils densely woolly: radial spines 20-30, slender, rigid, white; centrals 5-9, stouter, purplish above, the upper longer, erect, the lowest horizontal or deflexed: fls. 1 in. diam., pale purple: fr. $\frac{3}{4}$ in. long, red, with a conical cap formed of the withered remains of the fl.; seeds brown. Texas.—Four varieties of *M. tuberculosa*, vars. *caespititio*, *durispina*, *pubescens*, and *rufispina*, which have been distributed in European collections, doubtless belong here.

7. *dasyacantha*, Engelm. Simple, subglobose: tubercles terete, loose: radial spines 25-35, hair-like, white, with brownish apex; centrals 7-13, bristle-like, pale below, brown above, longer, the most interior one horizontal, sometimes wanting: seeds black, with nearly basal hilum. Texas.

CC. Fr. green; seeds brown.

D. The tubercles grooved only in upper half.

8. *macrómeris*, Engelm. Fig. 2314. Low, usually soon proliferous, dark green: tubercles large and long, loose and spreading, but often incurved; groove rather short: radials 10-17, weak, slender and spreading; centrals at maturity usually 4, somewhat stouter and much longer, sometimes more than 2 in. long: fls. purple, often 3 in. in expansion; petals erose, mucronate: fr. with several scales on the ovary. Along the Rio Grande from New Mex. to Texas.

DD. The tubercles grooved from top to bottom.

E. Glands 1 or more in the axils of the tubercles.

9. *macrothèle*, Mart. (*M. aulacothèle*, Lem. *M. Léhmännii*, Otto). Sts. stout, attaining nearly 2 ft. height



2314. *Mammillaria macrómeris*. ($\times \frac{1}{2}$)

by 4 in. diam.: tubercles long, conical, at first upright, in age becoming even deflexed: spines all yellow; radials 6-8, spreading; centrals 1-2, longer and stouter: fls. $1\frac{1}{2}$ -2 in. broad. Cent. Mex.

10. *raphidacantha*, Lem. Sts. becoming 1 ft. or more long, 2-3 in. diam., often clavate: tubercles erect-spreading, somewhat flattened, often with 1 or 2 glands

A. Stamens and style exerted beyond the petals; fls. irregular, slender, tubular, somewhat curved and bilabiate. (Subgenus *Cochemica*.)

1. *Pöselgeri*, Hildmann (*M. Roseana*, Brandeg. *M. Radiana*, Quell.). Upright branches 1-1½ ft. long, 1½-3 in. diam.: tubercles rather remote, flattened and appressed, later spreading; radial spines 8; central 1, brownish, strongly hooked, 1-2 in. long, twice as long as the radials: fr. bright red, flat on the broad top and much shorter than the tubercles.

2. *setispina*, Engelm. Upright branches 8-12 in. long, 2-4 in. diam., forming dense clumps: tubercles rather crowded, ovate, short: spines white with black tips; radials 10-12; centrals 1-4, stouter, the lower one strongly hooked, often twisted, 1½-2 in. long, 2 or 3 times as long as the radials: fr. red, much exceeding the tubercles. Low. Calif.

3. *Pöndii*, Greene. Upright branches 10-15 in. long, 1½-2 in. diam., making much smaller clumps than the two preceding; tubercles short, ovate, not crowded; axils setose; spines in 3 series, outer 15-25, short, white; inner 5-8, brown, longer; central row 3, brown, usually 2 of them strongly hooked, 1 in. or more in length, much exceeding the other spines: fr. oval or obovate, dull purplish red, $\frac{3}{4}$ in. long. Calif.

4. *Hälei*, Brandeg. Upright branches 1½-2 ft. high, 2-3 in. diam.: tubercles rather crowded, short-conical from a broad base: spines sub- to 3-serrate, outer 15-25; centrals 6-9, darker, the lower one much stouter, an inch or more long, usually straight but sometimes hooked, twice as long as the other spines: fr. obovate, red. Calif.

AA. Stamens and style shorter than the petals; fls. regular, short, tubular.

B. Tubercle on old plant with a narrow groove on upper side: fls. from the vertex of the plant.

C. Fr. red; seeds black.

D. Color of fls. yellow.

5. *missouriensis*, Sweet (*M. Nuttallii*, Engelm.). Nearly simple, 1-2 in. diam.: tubercles cylindric-conical, loose and spreading, slightly grooved: spines white, weak, puberulent, not hiding the body; radials 12-17, spreading; central one longer and stouter, often wanting: fls. about 1 in. long, yellow to fawn-color, with reddish streak; sepals fimbriate; petals acute or acuminate: berry red, the shape and size of a small pea; seeds black and pitted. Mont. to Kans. and E. Colo.

Var. *similis*, Engelm. Cespitose, in clumps often a foot broad: spines fewer: fl. and fr. larger. Kansas River to Texas.

Var. *robustior*, Engelm. (*M. Wissmannii*, Hildmann). Almost simple: tubercles longer and looser: spines

in the groove: spines yellow in the young state, soon gray; radials 6-10; central 1, longer and stouter, straight or hooked in the same plant: fls. about 1 in. broad. San Luis Potosí, Mex.—The more constantly hooked form is *M. aneistracantha*, Lem. The recently described *M. radicanissima*, Quehl., is very near *M. raphidacantha*, if not the same. It is found in the same locality.

11. *erecta*, Lem. Branching from base and from decumbent sts., attaining 12 in. or more in height by 3 in. diam., bright green: tubercles conical, short, upright: spines all yellow; radials 8-13; centrals 4 or less: fls. 2-2½ in. diam. Cent. Mex.—In the groove close to the spines is often found, especially in the flowering area, a conspicuous honey-gland.

12. *recurvata*, Engelm. (*M. recurispina*, Engelm. *M. nogalensis*, Runge). Sts. depressed-globose and often deeply concave, 6-8 in. diam., forming large masses 1-3 ft. diam.: tubercles short, with usually a large gland in the groove near the apex: spines yellow or whitish, stiff, recurved-pectinate, interwoven and covering the whole plant; radials 18-20; central 1, rarely 2, recurved: fls. about 1 in. long, brownish outside. Near Nogales, Ariz., and southward in Sonora.

EE. Glands none in the axils.

13. *Scheerii*, Mühlpf. (*Echinocactus Poselgerianus*, A. Dietr.). Sts. ovate-globose, 3-6 in. diam., usually simple: tubercles large and distant, deeply grooved, with 1-5 glands in the groove: spines stout, rigid, sometimes reddish; radials 6-16; centrals 1-5, stouter and longer, 1 very stout and porrect: fls. 2 in. long: seeds large for the genus. S. W. Texas and southward in Mex.—Mühlenpfordt described 2 species of *Mammillaria* under this name. The first one, founded in 1845, has purple fls., and is different from the one here described.

14. *robustispina*, Engelm. (*M. Brownii*, Toumey). Much like the preceding, but tubercles teretish, no glands in the groove or sometimes a single one at apex: spines very stout; radials 10-15; central 1, longer, straight, curved or even hooked, rarely an additional straight upper one: fls. 2 in. long, with very slender tube: seeds large. Babuquibari Mts. south of Tucson, Ariz.

15. *difficilis*, Quehl. Sts. simple, nearly globose, 2½ in. diam.: radial spines 12-14; central spines 4. Mex.

16. *cornifera*, DC. Tubercles ovate, thick, rather crowded: radial spines 15-17, ashy white, 6 lines long; central 1, longer and stouter, erect, somewhat curved. Mex.

17. *daimonoceras*, Lem. Vertex impressed, very woolly: tubercles erect-conical: spines grayish; radials 20 or more, the upper accessory ones fasciated; centrals usually 3, stronger, the 2 upper divaricate and somewhat recurved, the lower horizontal or recurved. Mex.

18. *Echinus*, Engelm. Differs from No. 17 in the less depressed shape and rather more numerous spines. S. Texas to Mex.

19. *echinoidea*, Quehl. A recent species, said to have come from Durango, Mex. It much resembles *M. Echinus*. It is also to be compared with *M. recurvata*. Fls. and fr. unknown. Not seen in Amer.

20. *scolymoides*, Scheidw. At length somewhat cespitose: tubercles conical, bent inward and imbricated: radial spines 14-20, whitish or horn-colored; centrals 1-1, longer and darker, the upper mingled with the up-

per radials, the lower stouter and bent downward: fls. 2 in. diam. Mex., south of the Rio Grande.

21. *radicans*, DC. Sts. simple: axils naked: tubercles oval, large: spines white, rigid, subtomtose. Mex. R.B. 40: 186.

22. *pectinata*, Engelm. St. simple: tubercles quadrangular at base, conical above; areoles round-oblong: spines 16-24, yellowish, laterally compressed at base, stiff, pectinate, somewhat recurved: fls. 2½ in. diam.; petals broadest above, obtusish. Pecos River and Leon Springs, Texas.

23. *impexicoma*, Lem. Vertex deeply impressed, densely woolly: tubercles somewhat angulate; areoles round: spines 18-20, gray, rigid, covering the whole plant; very rarely a single porrect central. Mex.

24. *sulcata*, Engelm. (*M. calcarata*, Engelm.). Densely cespitose from the upper part of the groove: tubercles 7-9 lines long, ovate-oblong, with dilated base, somewhat imbricate, spreading in age: spines gray, rigid, subulate; radials 12-15, the upper 3-5, fasciated; central 1, recurved, wanting in younger plants: fls. 2½ in. in expansion, the tube red within; sepals not fringed. Texas, from the Brazos to the Nueces River.

25. *Nielsæi*, Brandeg. (*M. Nickelsii*, Hort.). Very near the preceding, but radial spines more numerous, 14-18, the fasciated upper ones much longer than the lower, and no central. Mex., south of Laredo, Texas.

26. *conoidea*, DC. (*M. strobiliformis*, Engelm.). Ovate-conical, with densely woolly vertex: tubercles short, usually densely appressed-imbricate in 8-10 spiral, rib-like rows: radial spines 10-16, straight and stout; centrals 3-5, stouter, blackish, the upper ones erect-spreading, the lower stouter, horizontal or deflexed: fls. about 1 in. in expansion, deep purple, paler outside: fr. short, buried and hidden in the axillary wool. N. E. Mex.

27. *vivipara*, Haw. Fig. 2315. Low and depressed globose, usually cespitose, forming large masses: tubercles terete and loose: radial spines 12-20, slender but stiff; centrals usually 4, but sometimes as many as 8, brownish, the upper erect-spreading, the lower stouter and deflexed: fls. bright purple, 1-1½ in. in expansion; stigmas mucronate. From S. Brit. Amer., through the upper Missouri region to E. Colo.

28. *radiosa*, Engelm. Ovate or cylindrical, sometimes proliferous: tubercles terete: radial spines 20-30, white, with dusky apex, very unequal; centrals 4 or 5, stouter and longer, tawny, upper ones longer, lowest shorter and horizontal: fls. 1½-2 in. in expansion; stigmas obtuse. S. Texas and N. Mex.

Var. *neo-mexicana*, Engelm. (*M. Hirschiiana*, Haage f.). Lower, more or less proliferous from the lower grooves: radial spines 20-40, white; centrals 3-12, white below, blackish above.

Var. *borealis*, Engelm. Ovate or subglobose: radial spines 12-20; centrals 3-6, purple-spotted. Very near *M. vivipara*.

Var. *arizonica*, Engelm. Globose or ovate, large: tubercles long-cylindrical: radial spines 15-20, whitish; centrals 3-6, deep brown above: fls. large, rose-colored. N. Ariz.

Var. *deserti*, Engelm. Low, simple, with slender nearly cylindric tubercles: radial spines 15-20; centrals



2315. *Mammillaria vivipara*. (×½)

8-10, reddish tipped; fls. straw-colored, with purplish tips. Ivanpah, Calif.

Var. *chlorántha*, Engelm. Cylindrical, sometimes as much as 9 in. high; radial spines 20-25, almost in 2 series, gray; centrals 6-9, stouter, $1\frac{1}{2}$ -1 in. long, reddish only at tip; fls. greenish yellow. S. Utah.

Var. *Álversonii*, Coulter. FOXTAIL CACTUS. Robust and branching, sometimes 10 in. long, glaucous; tubercles short and broad, somewhat angled, forming more or less distinct ribs; radial spines numerous; centrals 8-14, stout, spreading, blackish half-way down; fls. pink. S. E. Calif.

29. *cornúta*, Hildmann. Depressed-globose or hemispherical, small, grayish green; tubercles large, flattened and imbricated; areoles round; radial spines 5-7, stout, short, compressed, radiant, grayish, the upper longer; central 1, stouter, as long as the radials; fls. rose-red. "In age the spines fall off and the plant, covered with imbricated, scale-like tubercles, reminds one of a pineapple." Mex.

30. *elephántidens*, Lem. Rather large, glaucous green; tubercles very large and thick, becoming horizontal or deflexed and somewhat bilobed; spines 6-8, all radial, stout, yellowish or gray, appressed to the plant and somewhat recurved; fls. rose-color, 3 in. in expansion. Mex.

BB. Tubercles never grooved on upper side.

c. Fls. large, yellow; tubercles elongated, of loose and soft texture.

31. *longimámma*, DC. Cespitose, bright green, forming large, low clumps; tubercles sometimes more than 2 in. long; spines straight, pubescent; radials 7-10; central 1; fls. 2 in. or more in expansion. Mex.

Var. *uberifórmis*, Schum. Tubercles darker green; radial spines seldom more than 4; centrals none.

Var. *globösa*, Schum. Tubercles dark green, very long; radial spines as many as 12; centrals 2-3.

Var. *sphárica*, Engelm. Tubercles about 1 in. long; radial spines 12-14; central 1. Texas.

cc. Fls. small, usually white or red; tubercles not elongated.

D. Seeds black.

E. Base of seeds brown corky.

32. *tetrancístra*, Engelm. (*M. phellöserma*, Engelm.) Ovale or ovate-cylindrical, rather large, simple or sparingly branched from the base; young axils sparingly setose; radial spines 30-60, in 2 series; exterior bristle-like, white; interior stouter and longer, dusky-tipped or purplish; centrals 1-4, longer, brown or blackish, sometimes all hooked, the upper ones sometimes straight; seed with a brown corky base. S. Calif. to Utah.

EE. Base of seeds not brown corky.

33. *micrómeris*, Engelm. Cylindrical-clavate, 1-6 in. high, covered by white spines; tubercles only $\frac{1}{2}$ line long; spines on the body very short, many serial, successively shorter toward the center, not pungent; in the flowering area the upper tuft of spines having a clavate deciduous tip; fls. pinkish white, borne at the summit in a dense tuft of wool and spines, directly behind the apex of the tubercle; fr. red, smooth; seed black. Texas.

Var. *Gréggii*, Engelm. Larger in all its parts. This species and its variety really do not belong to Mammillaria although they are usually placed here by gardeners. Var. *Greggii*, which is really specifically distinct from *M. micromeris*, has been referred to *Echinocactus*, although superficially it has no resemblance to that genus. Weber constructed for these forms the genus *Epithelantha*, and this will probably be the best disposition to make of this group.

34. *elongata*, DC. (*M. densa*, Link & Otto). Erect, 6-7 in. long, 1-1 $\frac{1}{2}$ in. thick; radial spines 16-18, yellow;

centrals none; fls. white or yellowish. Cent. Mex.—*M. viperina*, Purpus, was recently distributed abroad, but has not been seen in this country. It is said to be a form of *M. elongata*. Fls. and fr. unknown.

Var. *echinàta*, Schum. (*M. echinàta* and *M. echinària*, DC.). Radials as many as 20, yellow; centrals 2-3, brown.—A stout form.

Var. *ténuis*, Schum. (*M. tenuis*, DC. *M. minima*, Salm). Radial spines about 20, pale yellow; centrals none.—The most slender form, only $\frac{1}{2}$ in. thick.

Var. *stélla-auràta*, Schum. Sts. somewhat thicker; spines golden yellow; 1 central usually present.

35. *Leöna*, Poselg. Sts. stouter, glaucous, upper axils woolly; radial spines about 30, radiant, slender, white; centrals 6-12, much stouter; the upper ones longest, ivory-white at base, dove-color or bluish above. Nuevo Leon, Mex.

36. *decipiens*, Scheidw. (*M. Guilleminiàna*, Lem.). Irregularly cespitose, somewhat clavate, often rosy; tubercles cylindrical; axils sparingly bristly; radial spines 7-12, whitish; centrals 1-2, brown, longer; all slender. Mex.

37. *dumetörum*, Purpus. Minute plants, less than 1 in. diam.; tubercles prominent, terete, bearing long white hairs in their axils; spines spreading, white except at the yellow bases; fls. 6-7 lines long. Cent. Mex.

38. *frágilis*, Salm. Sts. low, usually as broad or broader than high, extremely proliferous, the offsets so lightly attached that they soon fall by their own weight; radial spines 12-14, white; centrals none or 1, rarely 2, white, with dusky tip. Mex.

39. *lasiacántha*, Engelm. Low, usually globose or depressed-globose; tubercles slender, axils naked; radial spines as many as 40-80, feathery; centrals none. Texas.

Var. *denudàta*, Engelm. (*M. Rüngei*, Hort.). Larger, both plant and tubercles; spines naked.

40. *plumösa*, Web. Densely cespitose, at length forming masses 6-10 in. diam.; axils long-hairy; radial spines about 40, feathered to the tip; centrals none.—This and the preceding are like feathery balls. *M. plumosa* is sold usually under the name of *M. lasiacantha*, to which it appears to be rather closely related. N. Mex.

41. *senilis*, Salm. "Proliferous at base; axils not setose; tubercles crowded; spines all white; exterior very numerous, erect-spreading, hair-like, flexuous; centrals 4-6, a little stronger, the upper and the lower hooked." Chihuahua, Mex.

42. *barbàta*, Engelm. Globose-depressed; axils not setose; exterior spines very numerous, pilose; interior stronger, yellowish, 10-15; central solitary, stout-hooked, yellowish, not much longer than the others; fls. small, not remote from the center; sepals fimbriate; berry "green." Near Chihuahua, Mex.

43. *vètula*, Mart. Subglobose or becoming sub-cylindrical; axils not setose; radial spines bristle-like, at first 25-30, obliquely spreading, later twice as many and horizontal; centrals 1-3, yellowish brown, scarcely stouter or longer. Mex.

44. *cándida*, Scheidw. (*M. spharótrieha*, Lem.). At length cespitose, globose, becoming longer; vertex depressed; axils setose; radial spines bristle-like, more than 50, horizontal and interwoven; inner spines, 8, 10, 12, or more, a little stouter and upright; fls. flesh-color or pinkish.

45. *pusílla*, DC. (*Cactus stellatus*, Willd. *M. stellaris*, Haw.). Low, globular, proliferous, making large masses; tubercles cylindrical, small and loosely spreading; axils with long, hair-like, tortuous bristles; radial spines 12-20, very soft and flexuous; centrals 4-6, yellowish, a little rigid, pubescent; fls. yellowish white. W. Indies.

Var. *múlticeps*, Salm. Larger: tubercles upright, crowded: radial spines numerous; centrals 6-8, slender, pubescent, reddish yellow. Mex.

Var. *texana*, Engelm. Larger than the last; spines in 3 series; outer capillary, crisped, 30-50; interior 10-12, a little more rigid, pubescent, white; centrals 5-8, longer, stouter, pubescent, yellow at tip. Texas and adjacent Mex.

46. *Bocasana*, Poselg. Depressed-globose, or a little lengthened, at length densely cespitose: axillary bristles as long or longer than the tubercles: radial spines 25-30, white, stiff at the base, each ending in a flexuous thread; centrals 2-3, slender, porrect, short, all yellow with brown tips, the hooked one brown nearly to the base, pubescent. Mex.

47. *Kunzeana*, Bodeker & Quehl. Plants small, growing in cespitose clusters, light green: tubercles cylindrical, with bristles in their axils: radial spines about 25, white, delicate but stiff; central spines 3 or 4, yellowish brown, one of them hooked: fls. white, with the outer lobes rose-colored. Mex.

48. *Wildii*, A. Dietr. (*M. Williana*, Otto). Cespitose, forming hemispherical clumps: radial spines 8-10, very slender, white, spreading; centrals usually 3-4, a little stouter and longer, honey-yellow, brown at base, pubescent, 1 hooked. Mex.

49. *dioica*, Brandeg. (*M. Goodrichii*, of Calif.). Simple or cespitose from the base, ovate to cylindrical, 3-8 in. high: tubercles somewhat angular and leathery: radial spines 11-22, white, with brown or purple tips; centrals 1-4, longer and darker, the upper turned up among the radials, the lower porrect and strongly hooked: fls. often unisexual, yellowish white with rosy streak. Calif. and Low. Calif.

Var. *insularis*, Brandeg. (*M. Palmeri*, Coulter, not of Jacobi). Sts. densely cespitose, shorter: axils densely woolly: spines much whiter, usually all straight. San Benito Isl.

50. *armillata*, Brandeg. Taller, often 1 ft. high, branching at base and along the st.: tubercles crowded: radial spines 9-15; centrals 1-4, nearly twice as long: fls. small, yellowish, scarcely spreading. Low. Calif.—The plant is marked by dark circular bands.

51. *Wrightii*, Engelm. Globose or depressed, top-shaped below: radial spines 8-12, white, pubescent; centrals 1-3, reddish black, scarcely longer than radials, all hooked: fls. about 1 in. long, purple. New Mex.

52. *Goodrichii*, Scheer. Erect, cylindrical, branching at base: axils naked: radial spines about 12, white; centrals 4, white below, brown above, the 3 upper erect-spreading, the lower longer. Cedros Isl. and Low. Calif.

53. *Grahamii*, Engelm. Globose or ovate, somewhat cespitose: radial spines 15-30, white, often dusky at tip, the upper ones shorter; centrals usually 4, usually blackish from a paler base, the 3 upper turned up among the radials, and, when pale, hardly to be distinguished from them; lower porrect: fls. rose-colored, 1 in. expansion: fr. nearly 1 in. long. From Texas to S. Calif. and adjacent Mex.

54. *fasciculata*, Engelm. (*M. Thornei*, Oerott). Plants sometimes growing in large clusters often containing many plants (as many as 110 have been noted): sts. cylindrical, usually 2-4 in. high but sometimes as much as 1 ft. high: radial spines 13-18, white, with dark tips: fls. broadly funnel-shaped, purplish; petals broad-acute. Ariz.—This species, although collected in 1848, has been poorly represented in our collections and unfortunately has recently been re-named. It is a very beautiful species.

55. *mazatlanensis*, Schum. (*M. littoralis*, Brandeg.). Plants growing in dense clusters, much branched at base: sts. globular to short cylindrical: spines numerous, usually brown and completely hiding the plant.

West coast of Mex.; sometimes erroneously referred to Calif.—This species does not do well in cult.

56. *venusta*, Brandeg. Globose or hemispherical, small, often cespitose: tubercles very thick and blunt, concave at the end, usually extremely glaucous: radial spines 9-15, stout, from pure white to white below and brownish above; central commonly 1, sometimes 2 or 3, the lower little longer and darker than the radials: fls. rose-color, $1\frac{1}{2}$ in. in expansion: fr. scarcely juicy, nearly 1 in. long, circumscissile near the base. S. Low. Calif.

57. *Mainae*, Brandeg. Hemispherical to ovate, usually simple: tubercles somewhat incurved, glaucous, the lower part and the axils often bright rose-red: radial spines 10-15, yellowish becoming gray, the upper shorter; centrals 1-3, the upper shorter and smaller, turned upward, one of them sometimes hooked, lower central stout, strongly hooked, somewhat twisted, yellowish below, black at tip: fls. flesh-color: fr. shorter than the tubercles. Vicinity of Nogales, Ariz.—Sent out as *M. Galeottii*.

58. *Cárretili*, Schum. Simple, depressed-globose, rather small: radial spines spreading-recurved and interwoven, rather long, yellowish; central 1, slender, chestnut-brown, paler below: fl. whitish, with rosy streak in petals; sepals long-acuminate. Mex.—The only specimen seen has bristles in the axils.

59. *ericantha*, Link & Otto. Cylindrical, elongated, $\frac{1}{2}$ ft. and more in height ("reaching 2 in.") by 2-2 $\frac{1}{2}$ in. diam.: tubercles crowded, acutely conical: spines all pubescent; radials 20-24, pale yellow, bristle-like; centrals 2, stronger, nearly twice as long as the radials, golden yellow, one directed upward, the other downward: fls. yellow, small: fr. yellow. Mex.

60. *sphacelata*, Mart. Sts. cespitose, cylindrical, 6 in. or more long, 1 in. diam.: tubercles short, conical from a broader, rhombic base: spines ivory-white with blackish tips; radials 12-18, horizontal-spreading; centrals 3-4, upright: fls. small, the petals acute. Mex.—The proper position of this and of the preceding species is still quite uncertain.

DD. Seeds brown.

E. The tubercles not exuding milk when pricked.

61. *spinosissima*, Lem. Sts. cylindrical, reaching 1 ft. high and 2 $\frac{1}{2}$ in. diam.: tubercles short, ovate-conic, somewhat tetragonal: radial spines 20-25, setiform, white, spreading; centrals 12-15, brownish red, stronger and twice the length of the radials. Mex.

Var. *sanguinea*, Haage. St. somewhat clavate, rather shorter and stouter: radial spines 18-20, spreading, white; centrals 8, only a little longer, but thicker and bulbous at base, white with brownish base and dark brown tip, the young ones dark blood-red. Mex.

62. *rhodantha*, Link & Otto (*M. Odieriana*, Lem. *M. fulvispina*, Haw.). St. long-cylindric or clavate, reaching more than 1 ft. high, usually 2-parted: axils bristly: radial spines 16-20, white, bristle-like, horizontal-spreading; centrals 4-6, rigid, white or yellowish, the upper black at tip. Mex.

Var. *pyramidalis*, Schum. Central spines dark brown, the young ones ruby-red.

Var. *Pfeifferi*, Schum. (*M. aureiceps*, Lem.). Radial spines 25 or more, yellow; centrals 6-7, recurved spreading, golden brown.

Var. *crassispina*, Schum. Radial spines 24-27, whitish; centrals 6-7, larger and stouter, more curved, darker.

Var. *fuscata*, Schum. Axils naked; tubercles 4-angled at base: radial spines 25-28, radiant, bright yellowish brown; centrals 6, stout, strongly curved, the upper very long.

63. *dolichocentra*, Lem. (*M. tetracantha*, Hook.). Subglobose (but said to reach a yard in height): tuber-

cles somewhat 4-angled; arcoles elliptic or rhombic: radial spines none; centrals 4, slender, rigid, the upper curved upward, 1-1½ in. long, the 3 lower half as long, all grayish brown. Mex.

Var. *Galeótti*, Forst. Radial bristles 8-14, very short, soon falling; centrals 4, seldom 1 or 2 more, spreading, yellowish, with points, the upper and lower longest. Mex.

64. *discolor*, Haw. Globose or ovate, glaucous: outer spines 16-20, white, radiant; interior 6, rigid, recurved, white below, black above, upper and lowermost very long. Mex.

65. *Lesauiniéri*, Schum. Hemispherical or very short-cylindrical (habit of *M. Heyderi*): spines brownish, short; radials 11-13; central upright, stronger.

66. *Haageana*, Pfeif. Cespitose: heads small, at length cylindrical, slender: tubercles small, crowded; axils woolly: radial spines about 20, pure white, only about 1½ lines long; centrals 2, black, slender, elongated, upper 3, lower 4 lines long. Mex.

67. *élegans*, DC. (*M. acanthophlegma*, Lehm. *M. Potosina*, Hort. *M. Klügii*, Ehrb.). Simple, then proliferous and densely cespitose, depressed-globose, later lengthened: tubercles crowded, very small: radial spines more than 20, bristle-like, about 3 lines long, pure white, interwoven and covering the whole plant; central spines 2 (1-3), with brown tips, the one directed

dark tips; central spines 4-7: fls. 6 lines long; petals cream-colored to a pale yellow: fr. clavate; seeds brown. Only known from the collection made by J. N. Rose on an island in the Gulf of California near La Paz in 1911.

73. *petróphila*, Brandeg. Sts. depressed-globose to short-cylindric, 6 in. high: tubercles milky, about 5 lines long; spines chestnut-brown or paler at base; radial spines 8-10; central spines 1 or 2: fls. greenish yellow. Mountains of S. Low. Calif.

74. *centricirra*, Lem. (*M. arietina*, and *M. deflexispina*, Lem. *M. Föhrsteri* and *M. Krämeri*, Mühlpf. *M. Schmidtii*, Sencke. *M. tetracantha*, Hort.). Copiously proliferous: tubercles pyramidal, 4-angular: spines irregular, mostly 4-6 radials and 1 central, sometimes only 1, sometimes 2 centrals with 1-2 very short radials or none; radials very stout, straight or curved, awl-shaped, reaching ¾ in.; central stouter, sometimes nearly 2 in. long; young spines yellow. Mex.

75. *mutabilis*, Scheidw. (*M. autumnalis*, Dietr. *M. cirrhifera*, Mart.). At length sparingly cespitose, depressed-globose or short-cylindric: tubercles pyramidal, 4-angled; axils with stout bristles in the wool: radial spines 1-6, very small; centrals 1-4, angled, flexuous, much longer, particularly the upper one, which reaches 2 in. Mex.

76. *Heeseana*, McDow. (*M. Petersonii*, Hildmann). Simple, glaucous or ashy green: tubercles pyramidal, 4-angled: radial spines 10-14, the 3 upper pure white and very short, the remainder longer and brownish-tipped; centrals 4, the upper ones erect and forming an elevated covering for the top of the plant, the lower one the longest, 2 in. long, and projecting. Mex.—Varies in color of spines.

77. *simplex*, Haw. Globose or short-cylindric: radial spines 12-17, the middle ones longest; centrals 4-5, somewhat longer, reddish: fl. brownish green without, yellowish or whitish green within: fr. red, ¾ in. long, clavate; seed brown.—This is the *Cactus Mamillaris* of Linnaeus and the first species discovered. It has for many years been a desideratum in our collections, although various species have recently been referred to it, like *Mammillaria nivosa* and *M. pusilla*. It has recently been re-discovered on the Isl. of Curacao and in N. Venezuela. This is the only species known from the S. American continent.

78. *nivosa*, Link. Grows in clusters of 25 or more specimens, forming clumps 2 ft. diam.: largest individual specimens sometimes 6 in. diam.: spines all yellow: tubercles very woolly in their axils: fls. cream-colored. Common on exposed cliffs of many of the W. India Isls.—A very beautiful species, but not often seen in cult.

79. *hidalgensis*, Purpus. Sts. simple, cylindric, sometimes 1 ft. high: radial spines none; central spines 4: fls. crimson. Cent. Mex.

80. *crucigera*, Mart. Sts. cylindrical, 4-6 in. high: tubercles closely set, with their axils full of white wool: radial spines numerous, 20 or more, bristle-like and spreading; central spines 4, yellowish: fls. crimson or purple. Mex.—An old species recently intro. into cult.

81. *Brändegei*, Coulter (*M. Gabbii*, Coulter). Depressed-globose to short-cylindric or clavate: tubercles slender: radial spines 9-16; centrals 1-4, sometimes shorter than the radials, and stout, sometimes longer and slender, white to brown: fls. reddish brown without, brownish green within: fr. clavate, white, tinged lilac. Cent. Low. Calif.

82. *Heyderi*, Mühlpf. (*M. texensis*, Lab.). Tubercles slender: spines short; radials 16-18, short, slender, white; central 1, darker, shorter than the lower radials, brown: fls. yellowish, with pale rosy streak in the petals. Ariz. to Texas.

Var. *applanata*, Engelm. Body much depressed, summit flat or concave: radial spines 15-22. Texas.



2316. *Mammillaria melacantha*. (X½)

upward, the other downward, about twice as long as radials, in the axils abundant long white wool. Mex.

EE. *The tubercles exuding milk when pricked.*

68. *bicolor*, Lehm. Simple or proliferous: tubercles small, crowded, ovate-pyramidal: radial spines 16-20; centrals 2, less than 1 in. long, stouter, erect, black-tipped. Mex.

Var. *nivea*, Schum. Obovate proliferous tubercles conical: radial spines capillary; centrals 4, white, with dusky apex, upper one incurved, 1 in. long.

69. *Parkinsonii*, Ehrb. At length dichotomously divided: tubercles slenderly pyramidal; axils woolly and bristly: radial spines 20 or more, slender; centrals 2, 3, 4, rarely 5, brown-tipped, the upper ones 3-4 lines long, the lower 1½ in. turned downward. Mex.

70. *formosa*, Scheidw. Nearly simple: tubercles 4-angled: radial spines 18-22, rather rigid; centrals 6, a little longer, stiffer, thickened at base, reddish or brownish tipped.

71. *angulàris*, Link & Otto (*M. subangulàris*, DC.). Densely cespitose: axils of the young tubercles setose as well as woolly: radial spines 3-7, the upper ones often very short, the lower one sometimes 3 in. long, occasionally a very long central present. Mex.

72. *àrida*, Rose. Sts. usually simple, globular, deeply seated in the ground, 1-2 in. diam.: tubercles very milky, nearly terete: radial spines about 15, pale, with

Var. *hemisphærica*, Engelm. Top rounded: radial spines 9-12. N. E. Mex.

83. *Macdougalii*, Rose. Plants low and somewhat flattened on top, but very old plants nearly globular and then about 5 in. diam.: tubercles flattened dorsally, strongly angled: radial spines 10-12, white or somewhat yellowish, tipped with brown or black; central spines 2, stout, yellowish, with brown tips: fls. over an inch long, cream-colored: fr. red, clavate. Common in the mountains about Tucson, Ariz., where it was collected by D. T. MacDougal, for whom it is named. This species is related to the Texan species commonly known as *M. Heyderi*.

84. *meiacantha*, Engelm. Fig. 2316. Usually simple: tubercles rather large, sharply angled and 4-sided, pyramidal: radial spines 5-9, mostly 6, white or yellowish; central 1, rarely a second, shorter and darker than the radials: fls. whitish, with reddish streak. Texas.

85. *cárnea*, Zucc. Body dark green: tubercles rather large, pyramidal, 4-angled: radial usually none, rarely 1-2; centrals commonly 4, in upright cross, stiff, grayish, with darker tip, in young growth dark brown or reddish: fls. reddish flesh-color. Mex.

86. *uncinata*, Zucc. Depressed-globose to subelavate: tubercles pyramidal, not strongly angled: radial spines 4-6, short, gray, dark-tipped; centrals 1, rarely more, longer and stronger, strongly hooked, dark. Mex.

87. *Trohártii*, Schum. Globose or depressed, small: tubercles very small, conical, scarcely angled: radial spines 5, white with dark brown tips, the lower longest; central 1, dark brown, stiff. Mex.

88. *sempervivi*, DC. Globose, blackish green, axils woolly: tubercles short, angled: radial spines 3-7, very short, only found on young tubercles; centrals only about 2 lines long, stout, conical, reddish, later gray: fls. dull white with reddish streak. Mex.

89. *Caput-Medusæ*, Otto. Depressed-globose, dull glaucous green, small: tubercles slender, angled at base: spines 3-6, very short, subulate, straight, reddish when young, later gray, pubescent: fls. whitish, red-streaked. Mex.

Mammillarias, in common with other cacti, run into many forms. Some of these forms may be valuable to the horticulturist, and yet not sufficiently distinct to warrant the giving of definite botanical names. The following names, not accounted for in the above review, are offered in the catalogues of American dealers: *M. Brändtii*,—*M. brúnea*,—*M. cirrhifera longispina* (see No. 75),—*M. Donatii*,—*M. filipendula*,—*M. fuscata Ledna* (see Nos. 35, 62),—*M. Lassomeri*,—*M. Lesauierii*(?),—*M. melandacantha* is an uncertain garden name,—*M. montana*,—*M. Nicholsonii*,—*M. Nickelsæ*(?),—*M. Rebsamiana*,—*M. recurrens*,—*M. rigidispina*.

The following species, mostly recently described, have appeared in foreign publications. None of them is being grown in Amer.: *M. Boedekeriana*, Quehl.,—*M. bombycina*, Quehl.,—*M. campylotricha*, E. Dams,—*M. collina*, Purpus,—*M. cordigera*, Heese,—*M. Emskoelteriana*, Quehl.,—*M. Joosensiana*, Quehl.,—*M. Knappeliiana*, Quehl.,—*M. Mündtii*, Schum.,—*M. napina*, Purpus,—*M. pilispina*, Purpus,—*M. ramosissima*, Quehl.,—*M. Ruéstii*, Quehl.,—*M. Sátorii*, Purpus,—*M. Seideliana*, Quehl.,—*M. trichacantha*, Schum.,—*M. uniæta*, Quehl.,—*M. Verhertiana*, Boedeker.

The following species are likely to appear in the trade at any time: *M. ceratites*, Quehl. This species has been associated with *M. Delatiana* and *M. durangensis*, but it seems to be very close to *M. conoidea*. It has not yet been intro. into American trade.—*M. Delatiana*, Quehl. Sts. club-shaped, about 3 in. high: tubercles grooved on the upper side: fls. large, pale yellow. Mex., sometimes credited to Calif.—*M. durangensis*, Runge. Very beautiful species with small central fls. Does not grow well in cult.—*M. pseudoperbella*, Quehl. A species recently intro. into Eu. Very close to *M. elegans*. Not yet cult. in Amer. J. N. Rose.†

MANDARIN ORANGE: *Citrus nobilis* var. *deliciosa*.

MANDEVILLA (Henry John Mandeville, British minister at Buenos Ayres). *Apocynaceæ*. Tall climbers from the warmer parts of America, with large funnel-shaped, 5-lobed flowers which are yellow, white or rarely tinged violet.

Woody plants: lvs. opposite, penniveined: racemes simple, often 1-sided, loose, dense or reduced to 2 or 3 fls.; calyx 5-parted, with several glands inside at the

base or 5 scales; corolla-tube cylindrical, funnel-shaped, or ovoid; lobes 5, broad, twisted; stamens fixed at the apex of the tube, included; disk of 5 lobes or scales; ovary of 2 distinct carpels; stigma thick: follicles erect or divergent, incurved and more or less cohering at apex, terete or angled.—Species 50 or more, Mex. to Argentina, but some of them probably to be referred to *Echites* or elsewhere. The species are little known as cult. subjects. The plants resemble *Dipladenia*, which see for cult.

suavcolens, Lindl. (*Echites funifórmis*, Gris., not Vell.). Sometimes called Chilean jasmine because of its climbing habit and large white or blush fragrant fls.: lvs. cordate, stalked, glabrous above, glaucous beneath; stipules pectinate: racemes with about 9 fls. each 2 in. across. Argentina. B.R. 26:7. B.M. 3797. G.C. III. 2:817. P.M. 16:289. R.H. 1845:167; 1913, p. 424. J.H. III. 48:413. G. 29:443. Some of the foregoing portraits may represent the following species, as the two have been confused.—Characterized by a pale, fleshy pectinate ring between the base of the calyx and corolla.

Tweedieana, Gad. & Stapf. Much like *M. suavcolens*, differing in having glabrous branches, long-acuminate or almost caudate lvs., longer petioles, lanceolate bracts, more fragrant fls. with lanceolate sepals, brilliant white corolla-limb and green tube. Probably Argentina. R.H. 1913, p. 425.

WILHELM MILLER.

L. H. B.†

MANDRÁGORA (name used by Hippocrates, said to signify that the plant is hurtful to cattle). *Solanaceæ*. MANDRAKE. Old medicinal herbs.

A genus of three or four species, one of which is supposed to be the dudain mentioned in Genesis, chapter 30. In America the name mandrake is applied to the mayapple, *Podophyllum peltatum*, but the mandrake of history is a plant with a large spindle-shaped root



2317. Mandrake.
From an old herbal.
(See Mandragora).

which was supposed sometimes to become forked and resemble the human form. In this condition it was used as an aphrodisiac. The plant was also called love-apple, and many superstitions about it still survive. The old herbals abound in fanciful pictures of the mandrake, one of which is reproduced in Fig. 2317. *M. officinarum* may be cultivated in the hardy border for its folk-lore interest. *M. autumnalis* is supposed by some to be the true mandrake. Both are natives of the Mediterranean region. *M. caulescens* is found in the Himalayas. The mandrakes are allied to belladonna (*Atropa*) and have poisonous qualities.

Mandragoras are mostly stemless perennial herbs with thick roots and large, stalked, wavy-margined lvs., the later ones being usually narrower and entire, and rather large fls. varying from whitish through bluish violet and purplish shades: fls. purple, bell-shaped, about 5-cut, netted-veined and borne in clusters among the tufted lvs.; calyx deeply 5-cut; sinus of the corolla induplicate between the lobes; stamens 5: fr. a globose or oblong juicy berry.

officinarum, Linn. (*M. officinalis*, Mill. *Atropa Mandragora*, Linn.). MANDRAKE. Lvs. ovate, the first obtuse, the others acuminate: calyx-teeth lanceolate, as long as the oblong berry. R.H. 1897, p. 131.

WILHELM MILLER.

MANDRAKE in America means the mayapple (*Podophyllum*) but the mandrake of history is *Mandragora*, above.

MANETTIA (Xavier Manetti, of the botanic garden at Florence, born 1723). *Rubiaceae*. Twining plants sometimes grown under glass for the ornamental flowers.

Glabrous or villous graceful climbers, evergreen: lvs. stalked, usually long-acuminate: fls. small or rather large, axillary, solitary or in short corymbs or panicles, white, yellow or red; calyx-lobes 4, rarely 5, short or long, narrow or broad; corolla-tube short or long, terete or angled, straight or curved, glabrous or pilose within; limb 4- (rarely 5-) lobed, the lobes usually short and erect or recurved, valvate; stamens 4 or 5, inserted at the orifice or in the throat of the corolla; disk annular or cushion-like; style filiform, the stigma entire or bifid: fr. an obovoid or turbinate 2-grooved 2-celled dehiscent many-seeded caps.—Perhaps 40 species, in warmer parts of Amer.

This genus includes the common manettia vine, *M. bicolor* and *M. inflata*, which have scarlet tubular flowers an inch or more long, with five spreading yellow tips. They are twining plants and are often trained to pillars and trellises both indoors and out, as they bloom more or less the year round. They can also be trained into a bushy form. The manettia vine is a rather old-fashioned plant, and generally easy of culture. It is fairly satisfactory as a cool conservatory vine, but is an easy prey to red-spider and mealy-bug. The flowers are short-lived, and not the best for cutting. Some gardeners prefer it to cupheas or *Jacobinia peruviansis*. Manettias are propagated by cuttings of young growth inserted in sand with bottom heat. For summer use the vines should have a sheltered but sunny position.

Manettias are very useful as roof-plants, or for growing on rafters and pillars. They may also be grown into specimen plants trained on a wire trellis. They may be rooted in a temperature of 60° to 65°. Put them in sand about 1 inch apart, shading them from the sun. Roots will soon form, when they may be potted, singly, in small pots, in two parts loam, one of leaf-mold, and one of sand. When the plants have gripped the soil, pinch out their points to encourage them to break. Put a few thin stakes around the pot to which to tie the shoots until they are large enough to be trained in their permanent position. Never allow the plants to become pot-bound, until the desired size of pot is attained, and be careful that the shoots do not get all tangled up, as it would be difficult to separate them, when it is desired to train them on a trellis, or in some other desirable position. Loam two parts, equal parts sand, and flaky leaves, a small part of well-rotted manure, is a good potting medium, for all future pottings. The night temperature should never be less than 55°. In summer, the plants that are grown on a trellis, in pots, may be placed outdoors on a bed of ashes, until the middle of September. Syringe manettias freely, as this keeps red-spider in check. Other insect pests may be kept down by fumigating with hydrocyanic gas as advised for other plants. (George F. Stewart.)

A. Corolla of practically the same color throughout.

glabra, Cham. & Schlecht. (*M. cordifolia*, Hort., not Mart.). Glabrous, much branched, woody below: lvs. cordate-ovate-acuminate, very short-petioled, glabrous and shining: fls. single on elongated solitary peduncles, crimson; corolla 1½ in. long, clavate-funnel-shaped, quadrangular; limb 4-parted, the short segms. deltoid and revolute; disk cushion-shaped; stamens conspicuously exserted. S. Brazil, Paraguay, Uruguay, Argentina. B.M. 3202. B.R. 1866. P.M. 2:267. B. 2:87 (all as *M. cordifolia*). The true *M. cordifolia*, Mart., apparently not in cult., is pubescent, with spreading corolla-lobes and included stamens.

micans, Poepp. & Endl. Handsome, differing from *M. glabra* in larger fls. which are borne several together on short axillary branches; the corolla-lobes spreading, and anthers nearly sessile; and the petioles shorter: fls.

bright red-orange. Andes region, Peru and Bolivia to Argentina. B.M. 5495.

coccinea, Willd. Probably not in cult., and its position apparently doubtful: twining: lvs. oval or ovate, long-acuminate, tapering to base: fls. scarlet (pinkish?), on rather stout bracted peduncles; corolla salver-shaped, the 4 lobes pointed and spreading-reflexed, the throat closed with yellow hairs and stamens included; disk hollow and adnate to calyx-tube; sepals apparently 8. Mex. to Colombia. B.R. 693.

miniata, Lem. Twining, somewhat white-hairy: lvs. oval-elliptic, thick, the base long-attenuate and apex acute or subacuminate, grayish pilose above: fls. solitary or twin, long-peduncled, cinnabar-red shading to rose; corolla funnel-shaped, hairy, the lobes 4, pointed, spreading; stamens included. Probably Andean, and very likely not now in cult. F.S. 4:317.

AA. Corolla yellow at apex.

bicolor, Paxt. Twining, glabrous: lvs. nearly sessile, lanceolate, slightly glaucous, acuminate: fls. single on short axillary peduncles; corolla ¾ in. long, little swollen at base, red below and yellow toward the top, the short lobes spreading-reflexed; calyx-lobes erect or spreading; style exserted. Brazil. P.M. 10:27.

inflata, Sprague (*M. bicolor*, Hort., in part). Fig. 2318. Recently separated from the cult. *M. bicolor*: differs in its leafy reflexed calyx-lobes, the corolla swollen at base, more coarsely hairy, and the yellow part of corolla much smaller; anthers not apiculate; style (in long-styled plant) about as long as corolla-tube. Paraguay and Uruguay. B.M. 7776 (as *M. bicolor*). G.C. III. 36:384. L. H. B.



2318. *Manettia inflata*. (×½)

MANFRÈDA ("named after an ancient writer on simples whose work is in the Parisian library"). *Amaryllidaceae*, tribe *Agavoideae*. Acaulescent bulbous plants, of somewhat the aspect of *Polyanthes*, but with nearly straight usually solitary flowers; closely allied to *Agave*, and requiring similar culture.

Leaves thin, lance-oblong, usually denticulate, dying in winter: infl. a raceme; fls. nocturnal, greenish or purplish white, tubular with spreading limb and protruding style and stamens. Chiefly Mexican. Monograph by Rose in Contr. U. S. Nat. Herb. 8, Part 1, 1903. The lvs. of most species are wavy or crisped at the margin.

A. Lvs. pubescent.

maculata, Rose (*Polyanthes maculata*, Mart. *Agave pubescens*, Regel & Ortg. *A. brachystachys pubescens*, Terr.). Lvs. brown-spotted: infl. 3 ft. high; fls. subsessile, 1¼ in. long; tube much longer than segm.; stamens long-exserted. S. Mex. Amoen. Bot. Monac. 19:13.

AA. Lvs. glabrous.

D. Stamens little exserted.

maculosa, Rose (*Agave maculosa*, Hook. *A. maculata*, Engelm.). Fig. 2319. Lvs. somewhat glaucous, mottled: infl. 3 ft. high; fls. subsessile, 2 in. long; tube somewhat longer than segm.; filaments in the throat. Texas. B.M. 5122. Bull. Soc. Tosc. Ort. 3. p. 308.

nn. Stamens long-exserted.

c. Tube of perianth longer than segm.

virginica, Salisb. (*Agave virginica*, Linn. *A. pallida*, Salisb. *A. carolinensis*, Lots. *A. Aliberti*, Baker. *Alibertia intermedia*, Mar. *Alce caroliniana*, Hill. *A. virginica*, Crantz). Lvs. green; infl. 3-5 ft. high, glaucous; fls. scented like mace, short-stalked, 2 in. long; tube thrice as long as segm.; filaments inserted at its base. S. U. S. Hardy. B.M. 1157. Jacq. Icon. 378. Lam., Encycl. 235. Hill, Hort. Kew. 13. Contr. U. S. Nat. Herb. 5, p. 155; 8, p. 15. Rep. Mo. Bot. Gard. 7:26, 27, 63. B.B. 1:445.—A form with mottled lvs. is var. *tigrina*, Rose (*M. tigrina*, Small. *Agave virginica tigrina*, Engelm.).

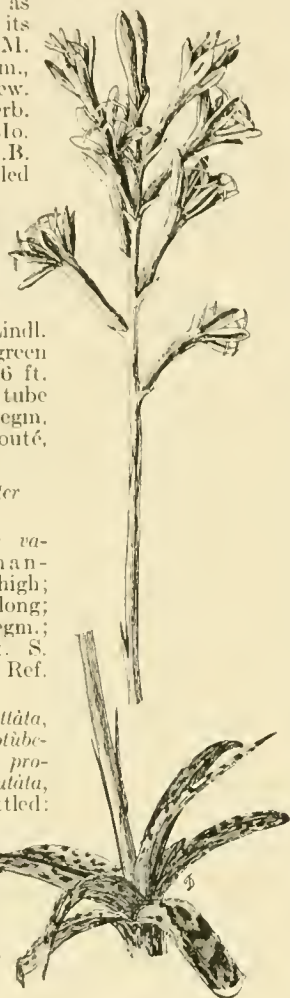
brachystachys, Rose (*Agave brachystachys*, Cav. *A. polyanthoides*, Cham. & Schlecht. *A. saponaria*, Lindl. *A. humilis*, Roem.). Lvs. green or reddened at base; infl. 6 ft. high; fls. sessile, 2 in. long; tube nearly twice as long as segm. Mex. and Guatemala. Redouté, Lil. 485.

cc. Tube of perianth shorter than segm.

variegata, Rose (*Agave variegata*, Jacobi). Lvs. channelled, mottled; infl. 3-4 ft. high; fls. subsessile, 1¼-1½ in. long; tube slightly shorter than segm.; filaments toward its throat. S. Texas and adjoining Mex. Ref. Bot. 326.

guttata, Rose (*Agave guttata*, Jacobi & Bouché. *A. protuberans*, Engelm. *Leichlinia protuberans*, Ross. *L. commutata*, Ross). Lvs. crisped, mottled; infl. 3 ft. high; fls. subsessile, 1-1¼ in. long; tube half as long as segm., the ovary protruding into it; filaments in throat. Mex. Biol. Cent. Amer. 87. B.M. 8429.

WILLIAM TRELEASE.



2319. *Manfreda maculosa*.

MANGEL-WURZEL. A race of beets with very large roots, grown for forage; usually shortened to mangel. Often called *Beta vulgaris* var. *macrorrhiza*.

MANGÍFERA (from *mango*, common name of one species, and Latin, to bear). *Anacardiaceae*. Tropical trees, of which *M. indica* is the only one well known horticulturally, and is cultivated throughout the tropics for its fruit, being naturalized in many regions. It is the mango of English-speaking countries, in its finer varieties one of the most delicious of all tropical fruits. Several other species also produce edible fruits, mostly, however, of indifferent value; their distribution is in nearly all cases limited. The Malay Archipelago is the home of nearly the entire genus, Malacca having a particularly large proportion of species. *M. indica* has been in cultivation since such a remote period that its exact origin is somewhat doubtful, but it has been considered by the best authorities to be

indigenous to the Himalayan foothills of eastern India, extending possibly through Burma into the Malayan region.

Leaves alternate, petiolate, entire, coriaceous; fls. small, polygamous, in terminal panicles; calyx 4-5-partite; corolla 4-5-petaled; petals free or adnate to the disk, imbricate; stamens 1-5, rarely more, inserted just within the disk; in most species there is commonly only 1 fertile stamen, the remainder being more or less abortive or reduced to staminodes; ovary 1-celled, oblique, the style lateral; fr. a large fleshy drupe, with a compressed, fibrous stone.—A genus of about 30 species, natives of Trop. Asia. Several allied genera are of horticultural importance, notably *Anacardium*, which includes the cashew (*A. occidentale*), *Spondias*, of which several species are cultivated for their fruits, known commonly as hog-plum, Spanish plum, and so on, and *Pistacia*, which furnishes the pistacio nut; all tropical or subtropical in distribution. The genus *Rhus*, which includes the sumac and poison ivy, and is well represented in warm-temperate regions, is also a member of the same family.

indica, Linn. MANGO. Fig. 2320. A large tree, erect or spreading in habit, 30-90 ft. high, with oblong-lanceolate to elliptic lvs. 6-16 in. long, variable in breadth, glabrous, deep green, the margins sometimes undulate, apex commonly acute; petiole 1-4 in. long, swollen at the base; panicles a foot or more in length, pubescent, rarely glabrate; fls. yellowish or reddish, odorless, subsessile, staminate and hermaphrodite on the same panicle; sepals ovate-oblong, concave; petals twice as long as sepals, ovate, 3-5-ridged, the ridges orange; disk fleshy, 5-lobed; stamens 1 fertile, 4 reduced to staminodes of varying prominence; anthers purplish; ovary glabrous; fr. 2-6 in. or more in length, usually compressed laterally, greenish, yellowish or reddish in color. N. India, Burma, and possibly Malaya, as noted above. B.M. 4510. H.U. 3:193.

zeylanica, Hook. f. A tree, glabrous throughout; lvs. oblong-ovate to elliptic-lanceolate, usually rounded at the apex, 2-3½ in. long; panicle stout, longer than the lvs.; fls. on slender pedicels; sepals orbicular; petals short, elliptic-oblong, disk large; fertile stamen 1, with 6-8 staminodes; ovary slightly pubescent. Ceylon, up to elevations of 3,000 ft.—Closely approaches *M. indica*, but said by Hooker to differ in habit and foliage, the contracted panicle, fls. with longer pedicels, perfectly glabrous sepals, and short petals.

fétida, Lour. BACHANG. AMBATJANG. A large tree, with elliptic-oblong to obovate lvs. 10-12 in. long, 3-4 in. broad, acute at base, acute to obtuse at apex; petiole stout, 1-1½ in. long; panicle large, stout, deep red; fls. subsessile; sepals ovate, obtuse; petals linear-lanceolate, reflexed, pink or red; stamens 5, 1 perfect, the rest shorter, imperfect; ovary glabrous, oblique, green, smooth, very fetid; flesh yellow, stone very fibrous. Distributed throughout the Malay Archipelago, where the fr. is eaten by the natives but is considered of very poor quality by Europeans.

odorata, Griff. KUWINI. BUMBUM. A tree, glabrous throughout, or with panicles slightly pubescent; lvs. elliptic-lanceolate to oblong, 6-12 in. long, 2-4 in. broad, acute or acuminate; petiole stout, 1¼-1½ in. long; panicle stout, green; fls. odorless; sepals ovate-oblong; petals linear-oblong, reflexed, greenish, suffused blood-red; perfect stamens sometimes 2, staminodes slender, capitate; ovary glabrous; fr. oblong, yellowish green, fetid, stone compressed, fibrous. A native of Malacca.—The fr. is said to be sweet, without any taste of turpentine.

cassia, Jack. BINJAI. A large, stately tree, with stout branchlets; lvs. cuneate-obovate to elliptic, 6-16 in. long, 2½-3½ in. broad, somewhat glabrous; petiole ¼-1 in. long; panicle stout, much branched; fls. on

short, stout pedicels; sepals broadly ovate, pubescent; petals erect, linear, concave, purplish; disk slightly lobed; perfect stamen 1, the imperfect ones reduced to teeth; style slender; fr. oblong-ovate. Malacca and other Malayan islands.—The frs. are eaten by the natives, but are said to be very poor.

verticillata, Rob. BAÜNO. A large tree, 50 ft. or more in height; lvs. in whorls of 4, narrowly elliptic-ovate to obovate, glabrous, about 4-6 in. long, 2-3 in. broad; petiole 1-1½ in. long; panicles 8-12 in. long, tomentose; fls. on stout, tomentose pedicels; petals narrowly oblanceolate, bluish, margins inrolled; fertile stamen 1, staminodes 4, irregularly shaped; fr. oblong-oval to pyriform, 4½-6 in. long, yellowish green; stone large, very fibrous.—A recently described species from the southern Philippines. Its fr., which ripens in Aug. and Sept. is described by Wester as "very juicy, rich, subacid, quite aromatic, of excellent flavor, partaking of the flavor of the apricot and soursop combined." It is thought to be of considerable horticultural value.

The mango.

To millions of persons living within the tropics, the mango is of greater importance than is the apple to those of temperate North America. While this is especially true in southern Asia, where the mango has been grown from time immemorial, the last two centuries have seen the tree widely disseminated throughout the tropical regions of the New World, and playing an important rôle in the dietary of the inhabitants. In its finer varieties the mango is certainly worthy of a place among the world's best fruits; for beauty of coloring, delicate subtle aroma, and piquancy of taste it has few equals. Yet it must be remembered that it is only among the choicest varieties that these characters are found, and the inferior, fibrous seedlings, which have always constituted the larger part and are all too frequently considered by visitors to the American tropics as representative of the best to be found among mangoes, have little in common with some of the superb varieties of the Orient.

DeCandolle considered it probable that the mango has been in cultivation 4,000 years. At the present time it is found growing naturally in the tropical Himalayan region, from Kumaon to Bhutan, at altitudes of 1,000 to 3,000 feet, and in several other parts of India, while it is cultivated extensively throughout the peninsula, except in a few regions in which the climatic conditions are unfavorable. References to the mango in the early literature of India are said to be numerous, and it seems always to have been held in the highest esteem and even veneration; its flowers are employed in religious ceremonies, and in some places annual celebrations are held in its honor. In the fourteenth century, the Turkoman poet, Amir Khusrû, wrote in Persian verse, "The mango is the pride of the garden, the choicest fruit of Hindustan; other fruits we are content to eat when ripe, but the mango is good in all stages of growth;" and the great Mughal emperor, Akbar, who reigned in the sixteenth century, planted near Darbhanga the famous Lakh Bagh, an orchard of 100,000 mango trees, some of which are said by Maries to remain to this day.

The dissemination of the mango throughout the tropical world seems to have been rather slow, considering the usefulness and importance of the fruit in India, but the difficulties in transporting seeds and plants in the early days, when travel by water was not rapid, must be remembered. Credit is probably due the Portuguese for carrying the mango to Africa, and later on to South America, where it is thought to have been first established in Brazil, but the date of its introduction to this continent is not definitely known. Within the eighteenth century it became scattered

throughout the West Indies and on the mainland of Central America. At the present day it is found in nearly every tropical region of the globe, and in some places its culture has been extended into the subtropics; thus it is grown in the Canary Islands, Madeira, occasionally along the shores of the Mediterranean, in Australia, northern India and the Persian Gulf region, southern Brazil, and the southernmost part of the United States.

The English name "mango" is from the Portuguese "manga," which is itself considered an adaptation of the Tamil "man-kay" or "man-gay" which was formed by the earliest Portuguese settlers in India. Some writers consider that the Portuguese name had its origin in the Malay "mangga" or "mangka," but Rumphius traces the introduction of the latter into the Malay Archipelago from southern India, along with the fruit itself. In northern India the name is "am" or "amba," these forms or variations of them occurring in very early literature; in Sanskrit it is "amra." In the western hemisphere the common names are adaptations of the Portuguese "manga" (the tree "mangueira"); thus it is called in both English and Spanish



2320. Fruits of the mango, *Mangifera indica*. (×½)

"mango," in French "mangue" (the tree "manguier"), in Italian "mango," in German "mango" (the tree "mangobaum"), and in Dutch "mangga" (the tree "manggaboorn").

The tree is evergreen, and varies greatly in height and habit of growth. In India there are several kinds which are low-growing, almost prostrate in habit, but ordinarily the tree is erect, either with a broad, dome-shaped, umbrageous crown, or else with a tall, oval, more or less open crown and ascending branches. On deep rich soils the mango reaches immense proportions; one specimen with a trunk 25 feet in circumference and a spread of 125 feet has been measured in Bahia, Brazil. A height of 70 feet is not infrequently attained. Budded or grafted trees do not reach such large proportions, neither do seedlings on shallow soils.

The lanceolate deep green leaves are of leathery texture, varying in length from 6 to 16 inches or even more, and when crushed emit an odor of turpentine, pronounced in some varieties and almost lacking in others. Growth is made in periodic "flushes" from the

terminal buds of the young branches; when a new flush makes its appearance its leaves are usually reddish or wine-colored, the color changing to green as the leaves mature. After the development of each flush there is usually a period of inactivity, following which another flush is made, each one varying in length from a few inches to a foot or more. The flowers, which are borne in large panicles a foot or more in length, produced in spring at the ends of the young branches, are yellowish or pinkish in color; there are sometimes 2,000 or even more on a single panicle, but only part of them are perfect, the mango being polygamous, i. e., producing on the same tree flowers in which both sexes are present and flowers which are unisexual. The staminate flowers greatly outnumber the perfect ones, as a general thing; there is, however, only one pollen-bearing stamen, the remaining four being abortive and represented by staminodes of varying prominence. The perfect flowers are easily distinguished from the staminate ones by the small obliquely round ovary, borne upon the swollen disk. The petals are ovate to lanceolate, commonly five in number.

In size and character of fruit the mango is extremely variable; there are varieties which are scarcely larger than a plum, and there are others whose fruits weigh as much as four or five pounds. The shape varies from round to long and slender, some of the commonest types being reniform, obliquely heart-shaped, oval, or elliptical. The skin is smooth, somewhat thicker than that of a peach, commonly yellow or greenish yellow in color, but in some varieties bright yellow overspread with scarlet or crimson, and of extremely beautiful appearance. Other types are uniformly pale lemon-yellow. The aroma is often delicious, spicy and tempting, and this added to the brilliant color, makes some of the finer varieties of the mango among the most attractive of all fruits. The stone is large, usually flattened, and in the ordinary seedling fruit covered with long, tough fibers, which extend from all sides into the yellow, juicy flesh. In the best grafted sorts there is no fiber and the fruit can be divided into halves, after making a longitudinal cut through the flesh, like a freestone peach.

The flavor, like that of many other tropical fruits, is difficult of description. Lady Brassey has likened it to a combination of apricot and pineapple, and others have compared it to the peach, yet neither of these comparisons conveys an accurate idea of the delicious piquancy and fragrance of a perfect mango, rich and sweet, yet never cloying, and overrunning with luscious juice. In seedlings there is often an objectionable taste of turpentine, especially in the skin; this, like the fiber, is done away with in the finer grafted varieties. However, it is sometimes true of the seedling fruit, as Junelle remarks, that while "there are those who do not like it because it smells of turpentine, there are others who come to like turpentine because it reminds them of the mango."

The mango is preëminently a dessert fruit, yet it lends itself to an infinite variety of uses, chief among which, in India, is the manufacture of chutneys and preserves. Mango chutney, of which there are numerous kinds, such as Major Grey's, Colonel Skinner's, Lucknow, and Bengal Club, is exported from India in considerable quantities. The unripe fruit is used in its manufacture, together with various other ingredients, principally spices. The unripe fruit is also used to prepare a dish known in India as "mango phul," a sort of custard made with milk and sugar. The ripe pulp, properly spiced, is dried in the sun to form thin cakes known as ambsath, a product which is, according to Woodrow, "the special solace and delight of Indian students in foreign countries." In Cuba and other parts of tropical America, the fruit is extensively used for the manufacture of jams and preserves. Exquisite sherbets and iced drinks are made from it, the Cubans

and Brazilians being especially skilful in preparing them. In recent years, canning factories have been started in India for the purpose of preserving the fruit in the same manner as peaches and pears are preserved in this country. There are varieties of the mango especially suited for culinary use, and others preferable as dessert fruits, just as with the more important temperate fruits.

In the United States, mango-culture has, in recent years, attracted considerable attention in southern Florida, where extensive experiments have been made with varieties from all parts of the world. In 1901 it was found that the tree could be successfully budded, and nursery stock began to be produced in sufficient quantities to permit of orchard plantings. The most extensive groves are found in the vicinity of Miami, on the lower east coast, but there are also numerous small plantations as far north as Palm Beach on the east coast, and at Fort Myers and other points on the west coast, extending as far north as Tampa Bay, where the trees are sometimes injured by frost, but nevertheless grow and fruit fairly well, especially in the vicinity of St. Petersburg. Florida has supplied nursery stock to plant several young groves in Cuba, the Isle of Pines, and Porto Rico as well.

In California, the culture of the mango is limited to the warmest locations, but fruit has been successfully produced at Sierra Madre, Santa Ana, Hollywood, and Santa Barbara. From past experiments, it appears that the tree is much better suited to the so-called frostless districts some distance from the seacoast than to such localities as Santa Barbara, for the reason that near the ocean there is not sufficient heat during the summer months to ripen the fruit. The dry climate of California seems to stunt the tree, and it develops much less rapidly than in the tropics, but with abundant irrigation it has made fairly good growth, especially in the deep sandy loam of some of the foothill regions. As to frost, the plants, when young, are easily injured by temperatures lower than freezing, but when they have attained a few years' growth they will withstand temperatures as low as 27° or 28°, provided they are not of long duration, without serious injury. Protection should be given wherever possible.

Cultivation of the mango.

In regard to soil, the mango does not seem to be very particular, but respecting climate it is much more exacting. Deep rich soils, like many of those found in Porto Rico and Cuba, produce a more rapid growth and greater ultimate dimensions, but the shallow sandy soils, underlaid with soft limestone, which are found on the lower east coast of Florida, have so far proved satisfactory, the mango requiring less fertilizer under such conditions than the avocado or some other tropical fruits. In India some of the best mango districts have a deep rich alluvial loam, somewhat sandy in nature, and this can probably be considered the best of all mango soils.

Granting that the mango is grown in a region free from injurious frosts, the most important climatic factor is the amount of rainfall, especially in regard to the season in which most of it occurs. In general it may be said that the mango produces the largest crops and most brilliantly colored fruit in regions in which there is a well-defined dry season corresponding to the blooming and ripening season; damp, cloudy weather while the trees are in bloom, even without any actual precipitation, is very prejudicial, and it has been thoroughly demonstrated in Florida that the best crops are produced in seasons when the weather is dry and sunny during the blossoming period. Moist weather favors the spread of blossom-blight or anthracnose (*Colletotrichum gloeosporioides*), a fungous disease that sometimes destroys all of the flowers. Many seedling mangoes, as well as some grafted varieties,

often produce a second crop of flowers if the first is destroyed. Trees in Cuba have even been known to flower four times; on the other hand, some mangoes bloom only once in a season. Spraying with bordeaux mixture, made in the proportion of five pounds of copper sulfate and five pounds of unslaked lime to fifty gallons of water, is often employed to prevent the blighting of the flowers, several applications being given while the trees are in bloom, commencing with the appearance of the first flower-buds. It is also well to spray occasionally during the time the fruits are developing, to prevent infection which may lead to rapid decay when the fruits are picked and shipped to market.

Regions where the annual precipitation is from 30 to 50 inches, and where a very small proportion of this occurs during the flowering season, seem to be ideal for the mango. Even in such regions, however, difficulty is often experienced in forcing some varieties to bloom, the mango showing a marked tendency toward irregularity in its fruiting habits. In tropical countries, various methods have been devised to encourage the formation of flower-buds and setting of fruits, such as partly girdling the trunk, hacking the trunk, severe root-pruning, placing common salt around the tree, and smoking the tree during the blooming period by keeping a smudge burning under its widespread branches. Most of these methods are out of harmony with modern horticultural practice, and of doubtful advisability, but it appears that something should be done in autumn to check vegetative growth and encourage the formation of flower-buds. Withholding all fertilizers at this season and moderate pruning of the roots may be suggested as of possible value.

In planting out young budded trees in orchard form, they should be set at least 30 to 35 feet apart, in holes prepared in advance. Late spring—April and May—is considered the best time for planting in southern Florida. During the first few years well-rotted stable-manure or sheep-manure can be used to encourage growth, but it should not be applied in large quantities, and after the trees reach bearing age the greatest care is necessary in applying fertilizers. For Cuban soils a fertilizer containing 3 per cent nitrogen, 10 per cent phosphoric acid, and 10 per cent potash has been recommended, fifteen to twenty-five pounds a year being given to mature trees. No fertilizers should be applied in fall or winter or during the time the trees are in flower. Little pruning is usually given the mango, though the trees may require some attention while young to encourage the formation of a symmetrical, well-branched head, which should not, however, be too dense. Grafted trees are usually spreading in form, and should be encouraged to remain so, especially in regions subject to occasional hurricanes.

Insect pests of the mango.

Of the insect pests attacking the mango, the fruit-flies (Trypetidae) rank first in importance. Belonging to this family are the Mediterranean fruit-fly (*Ceratitis capitata*) which has so adversely affected the fruit-growing interests of Hawaii, the Queensland fruit-fly (*Dacus tryoni*), the mango fruit-fly (*Dacus ferrugineus*), the Mexican fruit-fly (*Anastrepha ludens*), which has become troublesome in Porto Rico. The females of these flies insert their eggs into the flesh of the fruit by means of a most efficient ovipositor, and the larvae infest the fruit, rendering it unfit for human consumption, and in cases leading to premature ripening and decay. Control is difficult; the sweetened arsenical sprays have met with varied success, and natural control by parasites is now receiving attention. In India, the mango hopper (various species of *Idiocerus*) and the mango weevil (*Cryptorhynchus mangiferae*), which latter has now been reported as doing considerable damage in Hawaii, are of importance as pests. Cleanliness in the

grove by way of periodically gathering drops will prevent pupation of the fruit-flies and weevil and considerably reduce their numbers. In Florida, red-spider and thrips are responsible for extensive injury to foliage, leading to disturbances of the general health of the tree; but contact sprays, e. g., lime-sulfur or nicotine, properly applied, will effect complete eradication. Numerous scale insects have become injurious in certain localities and may be controlled by the use of kerosene emulsion, but the desirability of natural enemies such as the coccinellid beetles being present in the orchard must not be forgotten. A large bark-boring beetle (*Plocaderus ruficornis*) has been responsible for much damage to trees in the Philippines.

The mango crop.

The age at which budded or grafted mango trees will come into bearing depends upon the variety and upon several other factors, but they cannot as a rule be expected to produce fruit under three or four years from the time of planting, and in the case of some varieties this time is considerably extended. As to yield, some of the smaller-fruited varieties will produce several thousand mangoes in a single crop, when the tree is of mature size, while Mulgoba and other large mangoes are doing well when they produce a few hundred. Experience has been that the crop varies greatly in different seasons, and it has been impossible to fix a certain quantity as the average yield of any one variety. So much is dependent upon the weather at the time of flowering, with the consequent setting or dropping of flowers, that irregularities in bearing are all too common. Some mangoes, however, such as Cambodiana and Sandersha, have shown themselves much more dependable in this regard than others, and are especially valuable for this reason.

The fruit is picked when fully mature, but before it has commenced to soften on the tree. If allowed to remain on the tree too long, it is sometimes found that the flesh immediately surrounding the seed is unpleasant to the taste and of a peculiar gelatinous consistency. Shears should be used for picking, leaving a short section of the stem attached to the base of the fruit; this will dry up and fall off in a few days, but if the fruit is pulled from the tree the sap exudes freely from the stem end, disfiguring the surface.

The usual carrier used for mangoes in Florida is the tomato-crate, holding six small baskets. Each basket will contain six mangoes of good size, making thirty-six to the crate. The individual fruits are wrapped in tissue paper before packing, and excelsior is used above and below them as a cushion. Mangoes are shipped from south Florida to New York, Boston and Chicago, without difficulty, nearly always arriving in good condition if they were picked at the proper time. In recent years, the south Florida growers have received \$9 a crate for Mulgobas. The season during which they are shipped from Florida extends from late July until the latter part of August. Some varieties begin to ripen early in July, while the later ones, such as Sandersha, extend the season until the end of September.

Propagation of mangoes.

The simplest vegetative method, and the one extensively used in India, is that known as inarching or grafting by approach. While this is the most certain of all methods, it is too slow and laborious to meet the demands of present-day nurserymen, when more expeditious means can be found. Consequently budding is rapidly taking the place of inarching in this country, and though requiring considerably more skill it has proven entirely practicable for nursery work.

Inarching is performed between a large tree of the variety which it is desired to perpetuate and young seedlings grown in pots or boxes. The seedlings are ready for inarching when ten months to a year old;

they should have stems slightly less than $\frac{1}{2}$ inch in diameter. An easily accessible branch on the parent tree, of the same diameter as the stem of the seedling, should be selected for the cion, and the seedling in its pot placed upon a stage or support where the cion can be brought into close contact with it. The juncture where the inarch is made should be about 6 inches from the base of the seedling, and about a foot from the tip of the cion, which should be as straight and vigorous as possible. A thin slice of bark and wood about 3 inches long is removed from one side of the seedling stock, and a similar slice from one side of the cion; the cut surfaces are then bound closely together with waxed tape, or with raffia or soft string, and afterward covered with wax to exclude the air. Several months are required for a union to be effected, after which the top of the seedling is removed just above the juncture of stock and cion, and the cion is severed from the parent tree just below the juncture. Inarching is usually done in India at the beginning of the rainy season, but it can be successfully practised at almost any time of the year.

Seedling stocks for budding or grafting are easily grown. After removing the husk, the seed is planted in a 5-inch pot and barely covered with soil. As soon as germination takes place, the plants should be watched to see that not more than one shoot is allowed to develop; some mangoes are poly-embryonic and will produce six or eight shoots from a single seed. When the young plants are well started, which in Florida should be by early fall if the seeds were planted in midsummer, they may be set out in the field in nursery rows 2 feet apart, the plants 1 foot apart in the rows, and allowed to remain there until after they are budded. Field budding has been found much more satisfactory than budding in pots.

Several very distinct races of mangoes are known in cultivation, and as yet practically nothing has been done to determine which of these are of the greatest value as stocks, although there is every indication that this is an important question. In addition, some of the numerous other species of *Mangifera* may be of value for this purpose. As a general thing seeds of any variety are used, including those of the common "turpentine" mangoes, as they are called, which can usually be obtained in quantity at a very low price. The seeds should be planted as soon as possible after their removal from the fruit, as they do not retain their viability for many weeks. They are rather difficult to transport through the mails, especially when sent to distant countries.

The proper time for budding is when the plants have attained a diameter of stem as great as that of a lead pencil, or greater, and are just coming into flush, i.e., when the terminal bud is just starting to push out new growth. The budwood, which should be cut from vigorous, healthy trees, should be round, straight, smooth, and preferably of the second flush from the ends of the branches, the most recent flush of growth being discarded. The wood should be as dormant as possible, and the end of the branch from which it is taken should never show the wine-colored young leaves which are indicative of active growth. It is well to have wood which has hardened up sufficiently to have lost its bright green color and assumed a grayish cast.

The buds should be cut 1 to $1\frac{1}{2}$ inches in length, with a straight, sliding motion of the knife, aiming, if possible, to keep the blade parallel with the budstick. A thin, keen blade is essential. The incision is made in the stock in the form of a T or an inverted T, exactly as in budding citrus trees, and the bud is inserted without any more pressure than necessary. A strip of waxed tape is then used to bind it firmly in place. Cheap muslin is used for making the tape; after being torn into strips about 6 inches wide it is made into rolls 1

inch in diameter and boiled in a mixture of one pound beeswax and one-fourth pound rosin.

Edward Simmonds, who has worked out the budding of the mango in south Florida, considers April and May the most propitious months for inserting the buds. In strictly tropical regions the work can probably be done at any time of the year when the stock plants are in proper condition.

At the expiration of three to four weeks, the top of the stock is lopped, providing the bud shows signs of having formed a union; lopping should not be close to the bud, as this has been found to be dangerous.

Large seedling trees are often worked over to choice varieties by cutting off several of the main branches a short distance from the trunk, and allowing a number of sprouts to come out. When these have reached the proper size they can be budded in the same manner as seedlings.

Races, types and varieties of mangoes.

In different parts of the world several very distinct races of mangoes are found, which tend to reproduce their racial characteristics when grown from seed, though showing minor variations in form of fruit and other characters. One of the best defined races is that from the Philippines, which appears to be closely allied, if not identical, with the Cambodiana from Indo-China; several more or less distinct seedling types of this race are known in the Philippines, notably Pahutan, Carabao, and Pieo, and among these, in turn, are to be found slightly differing forms which when propagated by budding or grafting would constitute horticultural varieties. The Philippine race, which is polyembryonic, was brought to tropical America at an early day, doubtless by the Spaniards, and is the favorite in Mexico, where its seedlings are generally called "Manila mangoes," and in Cuba, where it goes by the name of "Filipino." In India, most varieties appear to belong to a mono-embryonic race which breaks up into more or less well-defined classes or types, of which there are in turn numerous horticultural varieties propagated vegetatively; thus of the well-known Bombay type, or group, as it has been called by some writers, there are several varieties, as also of the Langra, Malda and other types. In Jamaica the polyembryonic race known as No. 11 has become very popular because of the fact that it reproduces itself very closely when grown from seed (which most mono-embryonic mangoes fail to do) and has maintained its good quality for considerably over 100 years; it appears to be very closely allied to the Manga da Rosa of Brazil, and probably has other allies in the region from which it came. The relationships of the various races and types of mangoes has not as yet been thoroughly studied, and a good classification is lacking.

Of horticultural varieties there is an infinite and bewildering number, especially in India, where it appears to have been the custom to name almost every tree that produced fruit of superior quality; this has led to confusion and synonymy. One of the earliest Indian authorities on the mango, Maries, reported a collection of 500 varieties near Darbhanga, while large numbers of named varieties have been briefly described from many localities by various writers, bringing the number of published varietal names well up toward a thousand. Only a very limited number of these, however, such as the famous Alfonso or Alphonse of Bombay, have become well known and generally recognized.

The best Indian mangoes are probably not equaled in flavor and quality anywhere else in the world, though some travelers have professed a preference for the Philippine types, which are, indeed, very delicious. But the process of selection which has been going on in India for centuries, and the perpetuation of the best seedlings by inarching, has led to the existence of



LXVIII. A Paheri mango tree in fruit.—Florida.

remarkably fine mangoes in several parts of the Indian peninsula, most notably, perhaps, in the vicinity of Bombay, at Poona, at the Portuguese colony of Goa (where, in fact, it is thought by some writers that vegetative propagation of the mango was first introduced, the Portuguese having been instrumental in establishing this method which has meant so much to Indian horticulture), at Madras on the eastern coast, and in several districts toward the northern part of the peninsula, such as Malda, Darbhanga, Saharanpur, and Lucknow.

Grafted Indian varieties were first introduced to the United States in 1889, when the Department of Agriculture obtained from Bombay a collection of five kinds, which were placed with fruit-growers on Lake Worth, Florida, for trial. In the freeze of February, 1895, all save one of the trees perished; the surviving tree, a Mulgoba, came into bearing in 1898, and the superior quality of its fruit gave a marked stimulus to the cultivation of the mango in this country, resulting in the introduction of numerous other Indian varieties of reputed excellence. These have been added to by introductions from Indo-China, Ceylon, the Philippines, and other regions where good mangoes are grown. Among the best now grown in Florida and the West Indies are the following:

Mulgoba, which in delicate, aromatic flavor, smoothness and fineness of pulp, freedom from fiber, and attractiveness, must be placed in the very first rank. A good specimen will weigh about one pound, is broadly oval in shape, plump, clear yellow in color, blushed around the base with crimson-scarlet. Its season in Florida extends from July to the first of September. Unfortunately, it has proved irregular in its fruiting habits, and does not usually come into bearing as young as some other varieties. In some seasons considerable quantities of the fruit have been shipped from south Florida to northern markets, the growers realizing \$9 a crate of thirty-six fruits.

Haden is a fruit very similar in general characteristics to *Mulgoba*, of which it is believed to be a seedling. It originated at Cocoanut Grove, Florida. Good specimens weigh sixteen to twenty ounces, and are highly colored. The flesh is scarcely as smooth as that of *Mulgoba*, and the flavor not quite so piquant, but nevertheless very good. Its season corresponds to that of *Mulgoba*.

Paheri (probably synonymous with *Pairi*, which is now considered by the best Indian authorities the correct spelling of the name) was introduced from India in 1902, and has been found of excellent quality in Florida. Near Bombay, India, it is considered the finest flavored of all mangoes, but because of the superior keeping qualities of Alfonso the latter is preferred commercially. It is a fruit of about twelve ounces in weight, oval, plump, orange-yellow in color, blushed with scarlet on the cheek, the flesh deep orange, very juicy, and of rich, spicy flavor. It ripens in Florida in July and August.

Amini is a smaller fruit than any of the above, averaging six or eight ounces in weight; in form it is oblong-ovate, in color almost identical with *Mulgoba*. The aroma is remarkably penetrating and agreeable, while the flavor is unusually spicy. The tree is more productive than some of the larger varieties, and seems slightly more resistant to blight. It is a little earlier than *Paheri* in season.

Cambodiana, mentioned above as a polyembryonic seedling race, was introduced to Florida about 1902, and several of its seedlings have been propagated by budding. While they cannot be considered equal in flavor and quality to the best of the Indian mangoes, the tree is much more regular in its fruiting habits. The race is characterized by an elongated, compressed fruit, frequently rather sharp at the apex, and of a light yellow or greenish yellow color. The flesh is

yellow, juicy, of a pleasant flavor, but lacking the richness of *Mulgoba* or other good Indian mangoes, while the fiber is somewhat more abundant. In season it is a little earlier than *Mulgoba*.

Bennett is a select strain of Alfonso or Alphonse from Bombay which has been grown for several years in Florida. In quality it ranks very high, but it has been somewhat at a disadvantage in the markets because of its rather dull orange-yellow color. It is a fruit of about one pound in weight, oval to somewhat cordate in form, plump, with orange-yellow flesh and a seed almost entirely free from fiber. The season of ripening is July and August.

Sandersha is a very large fruit, frequently two pounds in weight, of elongated, somewhat curved form, orange-yellow in color. The flesh is free from fiber, and, when properly ripened, of pleasant flavor, though a trifle coarser than the best varieties. It is excellent for cooking, and because of its regularity in bearing is considered valuable. It ripens very late, beginning in late August and extending through September. F. W. POPEOE.

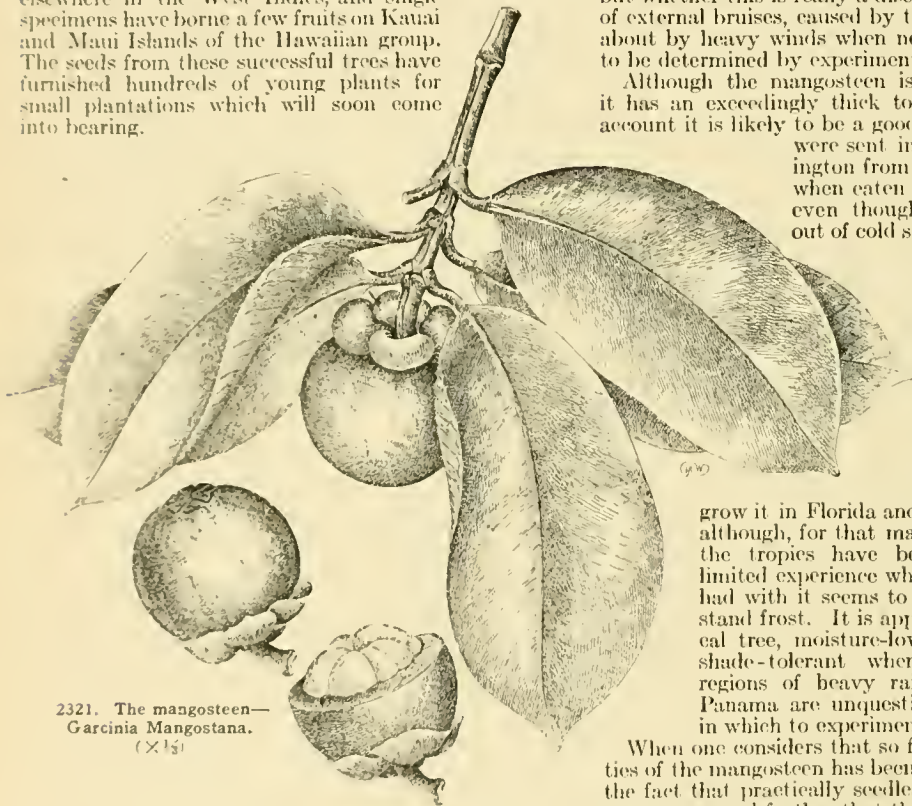
MANGOSTEEN (Fig. 2321), *Garcinia Mangostana* (which see), is a handsome fruit-tree 25 to 30 feet high, of compact growth, regular in outline, with dense, dark green foliage which reminds one slightly of the rubber tree. It grows slowly and comes into fruit late, not before eight or nine years of age. Its flowers are 1½ inches across with four rose-pink fleshy petals and a large superior ovary. In Ceylon the trees bloom twice, once in August, producing fruits which ripen in January, and again in January, producing fruits in July and August. In Trinidad the fruiting seasons are July and October. The January crop in Ceylon is a light one, however, not amounting to over 100 fruits to a tree, whereas the August crop amounts in good years to 500 or 600 fruits, according to Wright, of Mirigama, Ceylon. The fruits are borne from buds produced near the tips of short branches mainly on the outside of the tree, and are striking by reason of their persistent large leathery light green calyx-lobes.

This delicious fruit is about the size of a mandarin orange, round and slightly flattened at each end, with a smooth, thick rind, rich red-purple in color, with here and there a bright, hardened drop of the yellow juice which marks some injury to the rind when it was young. As these mangosteens are sold in the Dutch East Indies,—heaped up on fruit-baskets, or made into long regular bunches with thin strips of braided bamboo,—they are as strikingly handsome as anything of the kind could well be, but it is only when the fruit is opened that its real beauty is seen. The rind is thick and tough and in order to get at the pulp inside, it requires a circular cut with a sharp knife to lift the top half off like a cap, exposing the white segments, five, six or seven in number, lying loose in the cup. The cut surface of the rind is of a most delicate pink color and is studded with small yellow points formed by the drops of exuding juice. As one lifts out of this cup, one by one, the delicate segments, which are the size and shape of those of a mandarin orange, the light pink sides of the cup and the veins of white and yellow embedded in it are visible. The separate segments are between snow-white and ivory in color and are covered with a delicate network of fibers, and the side of each segment where it presses against its neighbor is translucent and slightly tinged with pale green. The texture of the mangosteen pulp much resembles that of a well-ripened plum, only it is so delicate that it melts in the mouth like a bit of ice-cream. The flavor is quite indescribably delicious. There is nothing to mar the perfection of this fruit, unless it be that the juice from the rind forms an indelible stain on a white napkin. Even the seeds are partly or wholly lacking and when present, are very thin and small.

Notwithstanding the fact that it has for at least two

generations been called the "queen of fruits" and that Queen Victoria offered a prize of ten pounds for the first fruits which should be brought to her from India, there appears to be nowhere in existence what would be called a large orchard of mangosteens. It is hard to understand why the culture of so delicious a fruit as the mangosteen should not have been better understood by horticulturists.

In the Dutch East Indies, Java and Sumatra in particular, it is planted by the natives in their kampongs as a dooryard tree. In Malacca and the Straits Settlements there are a few small orchard plantings owned chiefly by the Chinese. In Burliar Gardens in the Nilgiri Hills of Madras Presidency, British India, a few trees are growing. The native chiefs of the Sulu Archipelago have scattered plantings of mangosteen trees. A few small plantings have been made in Ceylon, notably a small orchard at Mirigama. Father D'Adran, a noted Bishop of Cochin-China, established an orchard of 300 to 400 trees at Lai Thieu not far from Saigon. Trees of it have grown and fruited in the Botanic Gardens of Jamaica, Trinidad, Dominica, and probably elsewhere in the West Indies, and single specimens have borne a few fruits on Kauai and Maui Islands of the Hawaiian group. The seeds from these successful trees have furnished hundreds of young plants for small plantations which will soon come into bearing.



2321. The mangosteen—*Garcinia Mangostana*.
($\times \frac{1}{2}$)

The reason for this very inadequate distribution of so remarkable a domesticated fruit-tree seems to lie in the difficulty which the young plants seem to have in establishing themselves. If the seedlings are not shaded, the first pair of young leaves is generally injured and the plants stunted or even killed outright. It is thought that horticulturists do not yet understand the root-system of the mangosteen and that when it is understood, a vast extension of the culture of this fruit will take place. This may come about through the use of stocks which are less particular in their soil-requirements. Geo. Oliver's experiments have proved that the mangosteen can be successfully inarched upon a number of the related species of the same genus. On *Garcinia xanthochymus*, which is a much more vigorous tree and grows on many

types of soil, and is apparently quite at home in Hawaii, Natal, Madeira, Cuba, and many other localities in the subtropics it seems to grow successfully. As 169 species of *Garcinias* have already been described, the probability is great of finding a suitable stock for the mangosteen.

The best orchards of mangosteen in Ceylon and Singapore have been established on soils characterized by a high clay content, combined with a large percentage of coarse material, with a very small amount of silt, and upon locations where the water-table comes to within 6 feet of the surface. The impression is current that the mangosteen requires a wet but well-drained soil and a very humid atmosphere. While the former statement appears to be true, the latter is not so, for the tree which has fruited on the Island of Kauai is in a dry but irrigated part of that island, with only 6 inches of rainfall, where it has to be irrigated twice a month.

The diseases of the mangosteen are not yet known. It is likely to have its own specific diseases, and when transplanted to new environments, may be attacked by new parasites. Fruits are frequently found with drops of yellow gumbo inside which make them unpalatable, but whether this is really a disease or merely the result of external bruises, caused by the fruits being knocked about by heavy winds when nearly mature, will have to be determined by experiment.

Although the mangosteen is a very delicate fruit, it has an exceedingly thick tough rind, and on this account it is likely to be a good shipper. Fruits which were sent in cold storage to Washington from Trinidad were excellent when eaten twenty-one days later, even though they had then been out of cold storage over a week. The

fact that when one of a shipment of fruits decays, its rind hardens instead of becoming soft, is an important point in its favor.

Just how much cold the mangosteen can stand has not yet been determined. Repeated attempts to

grow it in Florida and California have failed, although, for that matter, many attempts in the tropics have been unsuccessful. The limited experience which horticulturists have had with it seems to indicate that it will not stand frost. It is apparently a strictly tropical tree, moisture-loving and more or less shade-tolerant when young, adapted to regions of heavy rainfall; Porto Rico and Panama are unquestionably excellent places in which to experiment with its culture.

When one considers that so far no selection of varieties of the mangosteen has been made, notwithstanding the fact that practically seedless fruits are of frequent occurrence, and further that the tree belongs to a large genus of fruit-bearing trees, at least fifteen of which are known to bear edible fruit, some of them as large as small melons, and that these are scattered in Australia, the Malay region, South China, Africa, Brazil, and Central America, some of them being able to withstand light frosts, it becomes evident that in the development and breeding of the mangosteen and in the discovery of a suitable stock for it, there lies a most promising field for horticultural research.

DAVID FAIRCHILD.

MANGROVE. A name applied to certain small trees that grow along tropical and semi-tropical sea-coasts and produce many trunks or rooting shoots whereby the plant holds its place or marches on tide-flats. The name is usually restricted to *Rhizophora*

Mangle (*Rhizophoraceae*), which grows in tropical America and the seacoasts of Florida. The black mangrove is *Avicennia nitida* (*Verbenaceae*) of the Gulf coast and tropical America; and the name mangrove is applied to species of this genus in other parts of the world. For an account of the curious propagation of the *Rhizophora*, see page 980, "Cyclopedia of American Horticulture."

MANICÀRIA (name derived from the word for *glow*, because of the spathe). *Palmaceae*. Two or 3 species, or perhaps only 1, in Trop. S. Amer., little cult., allied to *Geonoma*. They are robust unarmed palms with more or less pinnatisect or entire lvs.; fls. large, rose-ochroleucous, heavy-scented, on many branching tomentose spadices; fr. very large. *M. saccifera*, Gaertn., has lvs. simple or split with age, dentate, 30 ft. long and 4-5 ft. broad, transversely furrowed, crowning an erect deeply ringed trunk; fls. of both sexes on the same spadix, the latter 3-4 ft. long; fr. 3-lobed. Lower Amazon and elsewhere. A striking palm with its immense simple lvs.

MÁNIHOT (native Brazilian name). *Euphorbiaceae*. Tropical trees and shrubs cultivated as ornamentals and for important economic products.

Usually glaucous and glabrous or nearly so; juice milky; lvs. alternate, entire to lobed or sometimes almost palmate; fls. large for the family, monœcious, in terminal or axillary racemes or panicles, apetalous; sepals united, at least at the base, imbricate, often petaloid; stamens 10; ovules 1 in each of the 3 cells; seeds carunculate.—About 130 species, all American and mostly in Brazil. Related to *Jatropha* and *Ricinus*. Although the plan of the infl. is different, several species of *Manihot* and *Jatropha* are otherwise so similar that they have been placed first in one genus and then in the other. Monogr. by Pax, in Engler's *Pflanzenreich*, hft. 44 (1910).

The cassava plant, *M. utilissima*, has been cultivated as a food plant since prehistoric times by the natives of Brazil. There are many varieties in cultivation and these are not known in the wild state. The plant is a perennial shrub in the tropics, and resembles somewhat the castor bean. The abundant starch in the large fleshy roots which grow in a cluster at the base of the stem gives it its food value. It is used in various ways as food, including the manufacture of tapioca, Brazilian arrow-root, and the like.

The roots contain more or less hydrocyanic acid which is often sufficient to render them deadly poisonous in the raw state. It is rendered harmless by heating or is pressed out with the juice in preparing the roots for food. The more poisonous varieties are generally known as bitter cassava, those with less of the acid as sweet cassava, but the amount of the poison varies with seasons and other conditions. Varieties of *M. dulcis* var. *Aipi* are also grown as sweet cassava in the tropics but are generally not very productive. *M. carthaginensis* is also sometimes used as cassava.

Cassava is grown in some of the warmer parts of the United States chiefly as a stock feed. It does best in light, but rich sandy soil. It is propagated by cuttings. Just before frost the more mature parts of the canes are cut and buried till spring and then cut into 4- to 6-inch pieces and planted 4 feet each way. The cultivation is similar to corn. In tropical countries the cuttings may be made and planted at any time. Some varieties, especially early maturing ones, may be grown from seed. The roots are left in the ground till used, as they decay quickly when harvested. The yield is from six to ten tons of roots to an acre, or even more. For further information on cassava, see "Cyclopedia of Agriculture," Vol. II, p. 227, and Farmers' Bulletin, United States Department of Agriculture, No. 167.

Manihot Glaziovii and other species have long been utilized for rubber in the wild state in Brazil. Some

years ago this species was planted extensively in various tropical lands out of its natural habitat, the general result being a low yield of rubber and disastrous failure of the enterprise. In recent years, plantations under proper conditions have given much better results. This is the chief source of the Ceara rubber, so called from the town of Ceara in Brazil. Other species are also worked for rubber in the native woods of Brazil. *M. dichotoma* and *M. piauhyensis* are also being grown in rubber plantations with success. All the Ceara rubber species grow in dry situations with little summer rainfall. *M. piauhyensis* is more shrubby and adapted to light sandy land and *M. dichotoma* to rough heavier soil. *M. heptaphylla* is also grown to some extent for rubber on light soil.

The Ceara rubber trees are grown from seed, but may be raised from cuttings. The seed is planted about 1 inch deep in good soil and kept moist till the seedlings are well established. The germination is slow and irregular, taking from three weeks to six months. Filing the seed-coat to hasten germination has been tried but often encourages decay. The young plants are cut back and transplanted into the field after the stem has hardened. They grow rapidly, the taller species like *M. Glaziovii*, reaching 16 feet in ten months. The smaller ones may yield a full crop in four years after planting. (See Ule. Notizbl. Bot. Garden, Berlin, 5, 1908.)

Some species of manihot are occasionally grown in greenhouses mostly for the tropical effect of the foliage. They are grown in light but rich soil and do best in a dry room. They are propagated easily from seeds but are usually grown from cuttings of young but firm wood in sandy peat under glass with bottom heat.

A. Bracts over 1 in. long, ovate to broad-lanceolate; calyx glabrous, $\frac{3}{4}$ in. long; shrubs or small trees.

piauhyensis, Ule. Tree, 6-20 ft. high; lvs. 5-7-parted, practically to the base, the lobes obovate-cuneate, obtuse, entire, mucronate, somewhat pubescent, 3-4 in. long; fls. racemose; caps. wing-angled. S. Brazil.—Cult. for rubber.

heptaphylla, Ule. Tree, 6-20 ft. high; lvs. 3-7-parted almost to the base, the lobes obovate-oblongate, some of them pandurately or sinuately 1-2-lobed near the apex, 4-5 in. long, acuminate, mucronate; fls. in short racemes; caps. subterete, not wing-angled. S. Brazil.—Cult. for rubber.

AA. Bracts much smaller, usually narrower.

B. Lvs. not peltate.

C. Lf.-lobes entire.

palmata, Muell. Arg. (*Jatropha palmata*, Vell.). Shrubby; lvs. deeply 5-11-parted, glabrous, base cordate; lobes of leaves, 3-5 in. long, lanceolate, acuminate; stipules small, deciduous; fls. racemose to sub-paniculate; calyx $\frac{3}{4}$ in. long, glabrous; caps. not wing-angled. S. Brazil.

utilissima, Pohl (*Jatropha Manihot*, Linn., in part. *Jánipha Manihot*, HBK.). BITTER CASSAVA. MANIOCA. MANIOC. TAPIOCA PLANT. SWEET POTATO TREE, and many other names in different tropical countries. Figs. 2322, 2323. An herbaceous shrub



2322. Flowers and fruit of *Manihot utilissima*. (Enlarged)

3-9 ft., or small tree in the tropics: roots fleshy, in a basal cluster: lvs. somewhat pubescent, deeply 3-7-parted; lobes 3-8 in. long, lanceolate, acuminate; stipules small, entire; fls. paniculate; calyx less than $\frac{1}{2}$ in. long, pubescent inside; caps. wing-angled. Brazil. B.M. 3071. —Cult. in many varieties and naturalized in various tropical lands.

dulcis, Pax (*Jatropha dulcis*, Gmel.). Shrub, 3-12 ft. high: roots similar to the preceding species but generally smaller: lvs. deeply 3-13-parted; lobes lanceolate to obovate; stipules narrow, pointed, subentire; fls. paniculate; calyx $\frac{1}{2}$ - $\frac{3}{4}$ in. long, pubescent inside; caps. not wing-angled. Var. *Aipi*, Pax (*M. Aipi*, Pohl. *M. palmata* var. *Aipi*, Muell. Arg.). SWEET CASSAVA. *Aipi*. Younger parts pubescent: lvs. 3-7-parted; lobes obovate to elliptical-lanceolate. Wild in Brazil and cult. there and elsewhere in the tropics. Var. *multifida*, Pax (*M. palmata* var. *multifida*, Muell. Arg.). Lvs. long-petioled, 7-13-parted, mostly glabrous; lobes spatulate-lanceolate to lanceolate. S. Brazil. H.I. 530.



2323. *Manihot utilissima*, the roots of which produce tapioca.

cc. *Lf.-lobes sinuate or pandurate or shallowly lobed near the apex, acuminate.*

carthaginensis, Muell. Arg. (*M. Jauipha*, Pohl. *Jatropha carthaginensis*, Jacq.). YUQUILLA. Tree: lvs. 5-7-lobed; lobes lyrate-sinuate; stipules entire; fls. racemose; calyx glabrous, about $\frac{1}{2}$ in. long; caps. not wing-angled. S. Texas to Venezuela in sandy soil.

dichotoma, Ule. Tree: lvs. deeply 3-5-parted; lobes broad, entire to sinuate or pandurate; stipules denticulate; fls. in short racemes; calyx $\frac{3}{4}$ in. long, pubescent inside; caps. wing-angled. S. Brazil. H.I. 2876, 2877.

bb. *Lvs. pellate.*

Glaziouii, Muell. Arg. CEARA RUBBER TREE. MANISBOA. Tree, up to 40 ft. high: lvs. deeply 3-5-lobed; lobes 3-4 in. long, entire, ovate-oblong to elliptical, short-acuminate; stipules denticulate; fls. paniculate; calyx glabrous, about $\frac{1}{2}$ in. long; caps. not wing-angled.

S. Brazil and cult. and naturalized in many tropical countries. Jour. Bot. 18:321.

M. diversifolia, Muell. Arg. = *Jatropha integerrima*, Jacq.

J. B. S. NORTON.

MANURE (from old French *manavrer*, to cultivate by hand; connected with Latin *for hand and work*). In the broadest sense, manure is any substance applied to the soil for the purpose of increasing productivity. The excrements of animals, mixed or unmixed with straw or other absorbents, are usually spoken of as barn-manures. Commercial manures or "fertilizers" are usually concentrated forms of nitrogen, potash and phosphoric acid, mixed or unmixed (see *Fertilizers*); green manures are living plants plowed under to furnish humus and increase productivity; amendments are substances, such as lime, which may increase the growth and healthfulness of plants by improving the physical condition and modifying the chemical reactions of the soil. In general farming, barn-manures are usually applied in the raw or unrotted state; in horticulture, rotted or partially rotted. Horse-manure is used for hotbeds, while cow-manure, mixed with soil, is best for forming a moist rich potting earth. Dung, the solid voidings of animals, after weathering for a time, is also a valuable addition to potting earth. Florists often keep a number of dairy cattle that an abundant supply of bovine manure, which is so valuable in floriculture, may be at hand. Commercial manures are used in small quantities, either direct or in solution. Nitrogen stimulates the vegetative system and tends to produce rapid growth and dark foliage. Phosphoric acid, among other effects, has that of producing well-developed plump seeds and fruits; potash may augment these effects, as well as increase and intensify the color of the bloom.

Barn-manures are more highly prized than formerly. Waste of their valuable constituents is now largely avoided either by applying them to the land day by day, as they are produced, or by more rational methods of caring for them until they are partly rotted or opportunity is afforded for most suitable application to the land. Covered yards or pits are now sometimes used for temporarily storing manures, where they can have water

added if too dry and if likely to "firefang;" or absorbents, such as straw, dry muck, gypsum and the like, may be used if they are too watery. When bedding is abundant, the animals may take their exercise in the covered yard, as they will solidify the manure by tramping it, thereby diminishing loss by too rapid fermentation. Both salt and gypsum conserve plant-food in manures when spread over the mass from time to time in small quantities. The quantity and value of manure made by domestic animals is not realized by those who allow it to be scattered over large open barnyards or allow it to remain for considerable periods under the eaves of the barn. Extended experiments at the Cornell Experiment Station showed that the following amounts of excrements were produced daily for each 1,000 pounds of live weight of animal:

	Pounds
Sheep.....	34.1
Calves.....	67.8
Pigs.....	83.6
Cows.....	74.1
Horses.....	48.8
Fowls.....	39.8

Animals fed on a highly nitrogenous or narrow ration (as 1:4), as were the pigs in the above investigations, consume large quantities of water and produce a large amount of manure, the weight of which often exceeds the amount of food consumed; while those fed on a carbonaceous or wide ration (as 1:9) consume comparatively little water and produce less weight of manure.

Some conditions affecting the production of manure and its value may be stated as follows: If the plant-food value of manure is computed at the price that is paid for the same constituents in fertilizers, it is found that the value of manure produced by animals is equal to 30 to 50 per cent of the cost of their food. Young animals produce poorer manure than mature ones. The excrements of animals which give a product, as milk or young, are poorer than those from non-productive animals. The more abundant the ration the less complete the digestion and the greater the value of the manure produced. Concentrated and nitrogenous foods result in richer and more valuable excrements than unconcentrated or carbonaceous foods. Liberal salting and excessively succulent foods diminish the value a ton of manures. The amount and kind of bedding affect not only the quantity but the value a ton. Animals kept in cold quarters drink little water, digest their food closely and produce a manure relatively small in amount and poor in quality.

Rich manures are relatively more valuable to the unit of contained fertility than poor ones, because their fertilizing constituents are more quickly available than are those of poor ones. Plants receive greater benefit from extra nourishment in the early stages of their growth than when they approach maturity. Coarse low-grade manures should be weathered or rotted to improve their availability, even though some loss may occur. A unit of plant-food in high-grade fertilizers or well-preserved rotted manures is worth more than in low grades. The valuable constituents in farm-manures are not so quickly available as they are in high-grade fertilizers, but they have an additional value, since they furnish humus, lighten the soil, inoculate it with nitrifying organisms and increase its power to hold moisture, while assisting in liberating the mineral constituents of the soil. The value of manure as set down below is determined by investigations during the winter months, and the nitrogen, phosphoric acid and potash are computed at 15, 6 and 4½ cents a pound, respectively. The indirect beneficial effects of manure are considered an equal offset for the slightly less availability of their plant-food constituents as compared with fertilizers:

Kind of manure.	Value a ton.
Sheep.....	\$3 30
Calves.....	2 17
Pigs.....	3 29
Cows.....	2 02
Horses.....	2 21

Limited amounts of bedding were used in the tests from which the foregoing figures were made.

Kind of animal.	Value a year.
Fowls (1,000 pounds of)	\$51 10
Sheep " " " " " "	26 09
Calves " " " " " "	24 45
Pigs " " " " " "	60 88
Cows " " " " " "	29 27
Horses " " " " " "	27 74

Usually these animals are kept in the stables but half of the year, and inevitably some loss will occur; therefore it will be safe to estimate the recovered value a year at one-third to one-fourth of the above.

Heretofore the waste of the valuable constituents of manures in the United States has been very great. Until recently, large open barnyards have been the rule. In the northern and central parts of the United States the rainfall exceeds 30 inches per annum. Many

barnyards contain from $\frac{1}{4}$ to $\frac{1}{2}$ acre. One inch of rainfall equals 113 tons of water an acre. If this be multiplied by thirty, a fairly accurate estimate is secured of the water which largely passes through or over the manure and carries off its most soluble and hence most valuable constituents. The loss of value in manures exposed at Ithaca, New York, in loose heaps of two to ten tons, during six months, was as follows:

	Per cent
1889, Horse-manure	42
1890, Horse-manure	62
1890, Cow-manure	30
1889, Mixed, compacted	9

Even in horticulture, where a more liberal use of manure than in general farming is admissible, too much reliance is often placed on manures and too little on tillage. Manures may furnish plant-food, improve the physical condition of the soil, conserve and increase heat and moisture. Ten to twenty times as much food as the plants can utilize is frequently applied at one dressing, which is poor economy, since manures give best results when applied in moderate quantities, in a well-rotted condition and in close contact with the seed. Growth and development are more largely determined by the amount of moisture than by the amount of plant-food. Five tons of preserved barn-manure contain of nitrogen, phosphoric acid and potash, sixty, thirty and forty-five pounds, respectively. Twenty-five bushels of wheat, with straw, contain forty-five pounds of nitrogen, eighteen pounds of phosphoric acid, and twenty-seven pounds of potash. Most soils contain large amounts of unavailable or difficultly available plant-food. Manures should be used largely to feed plants between the time the nutrients in the seed have been exhausted and that when the plants have secured a firm hold on the soil by manifold rootlets. Except when otherwise most suitable and convenient, fresh manures should be spread thinly in the autumn or early winter on the surface where plants are growing, thus imitating nature's methods of maintaining and increasing productivity.

It is usually found to be both difficult and expensive to maintain productivity by means of barn-manures supplemented with light applications of fertilizers. In this case, unless plant-food can be secured from outside sources easily, recourse should be had to green-manuring. In some cases this is the cheapest and the best method of rejuvenating old, weedy, tired lands. By raising and plowing under two crops—one at least a legume—in one season many weeds may be destroyed, quantities of humus and nitrogen added, and inert plant-food transformed into readily available forms. At the same time the soil is improved physically and its power to pass the free water of precipitation through its subsoil is augmented while the tendency to puddling is diminished. Added humus and tillage combined hasten nitrification and the liberation of inert mineral plant-food while imparting to the land a greater capacity to hold moisture by capillary action. See *Fertility*.

I. P. ROBERTS.

I. P. ROBERTS.

MAPÀNIA (an aboriginal name). *Cyperaceæ*. Grass-like or sedge-like plants, sometimes grown under cover for the foliage effects.

Stem very short, bearing long and often striking lvs.: scapes mostly leafless, bearing congested infl.: spikelet of 6 (sometimes 5) glumes: fr. a bony nut either dry or succulent.—There are perhaps 50 species in the tropics of both hemispheres, comprising strong often tall-lyd. perennial herbs. Two species, apparently good pot subjects, have been listed in recent years. *M. pandanifolia*, Hort., is represented as dracena-like, caulescent, 3–4 ft. high, with long narrow graceful stiffish lvs. 24 in. long by 1 in. wide. *G.C.* III. 21:349. *Gt.* 46, p. 523. It is perhaps *M. Pandanophyllum*, Schum. & Hollr., which is *M. hypolytrodes*, Benth., of

Malay peninsula to Austral. (*Pandanophyllum hypolyroides*, F. Muell. *Hypolytrum Pandanophyllum*, F. Muell.). This much-named plant is separated by C. B. Clarke as *Thoracostachyum hypolyroides*, Clarke, a genus differing from Mapania in its corymbose rather than congested spikes. The lvs. are described as 4 ft. long and 1-2 in. broad, with scabrous edges: lowermost involucre bracts 1-2 ft. long and 1-2 in. broad, tapering to long points: spikelets very numerous, whitish.

Apparently the only other species recently offered regularly is *M. humilis*, Naves & Vill. (*M. lucida*, N.E. Br.). Rhizome short and woody, terminating in a short st. or crown bearing a top of densely equitant lvs., which are 2-3 ft. long, 3-nerved, sharp on margins and keel: scapes from the lower axils, the mature infl. ovoid, the bracts shorter than the head. India.

L. H. B.

MAPLE: *Acer*. Flowering *M.*: *Abutilon*.

MAPROÛNEA (Guiana name). Sometimes spelled *Maprounia*. *Euphorbiaceae*. Trees and shrubs, not in cult., but used for medicine and the like, in their native land. Glabrous: juice milky: lvs. entire, pinnately veined: infl. terminal; fls. apetalous, monœcious; staminate calyx 2-3-lobed, lobes imbricate; stamens 1-3, filaments connate; ovary 3-celled; 1 ovule in each cell: seed earunculate. Four species in Trop. Amer. and Afr. Related to *Stillingia* and *Hippomane*. *M. brasiliensis*, St. Hil., MARMELIERA DE CAMPO, and *M. guyanensis*, Aubl. MENUDITO, of Trop. S. Amer., are the chief species.

J. B. S. NORTON.

MARANG, *Artocarpus odoratissima*, of the family *Moraceae*, is a recently discovered fruit-tree from the southern Philippines and the Sulu Archipelago, which has been introduced to the United States and is thought to possess considerable value for tropical regions, though it will probably succeed only in very warm and humid climates. It belongs to the same genus as the bread-fruit (*A. incisa*) and the jak, or jack-fruit (*A. integrifolia*), but is said by Wester, who first brought it to the attention of horticulturists, to produce a fruit superior in quality to the Philippine forms of either of these. The tree is medium-sized, and similar in habit to the bread-fruit, with large, dark green, entire or trilobate leaves 18 to 24 inches long by 10 to 12 inches broad. Wester describes the fruit as "large, about 6 inches long and 5 inches in equatorial diameter, roundish oblong, regular, thickly studded on the outside with soft greenish yellow spines $\frac{1}{2}$ inch in length; rind thick and fleshy; flesh white, sweet, rich, juicy, aromatic and of good flavor, separated into segments (of about the size of a grape) clinging to the core, each segment containing a seed; the seeds many, whitish, $\frac{1}{2}$ by $\frac{3}{5}$ of an inch, smooth, separating readily from the flesh. When the fruit is ripe, by passing a knife around and through the rind, with a little care the halves may be separated from the flesh, leaving this like a bunch of white grapes." It is said to ripen during August in the Philippines. For

species related to *A. odoratissima*, Blanco, see the article *Artocarpus*, pages 401, 402, Vol. I. F. W. POPEOE.

MARÁNTA (B. Maranta, Venetian Physician and botanist, died 1754). *Marantaceae*. Greenhouse pot plants, grown mostly for the foliage.

Perennial herbs, tall or low, erect or prostrate, the flowering part more or less branched: lvs. petiolate, radical and cauline: fls. racemose or paniculate; sepals 3, equal, lanceolate or lance-oblong; corolla more or less tubular, usually enlarged or gibbous at base, the 3 lobes subequal and somewhat hooded at the apex; 2 exterior staminodia petal-like, usually obovate, showy; ovary 1-celled by abortion.—Species 23 in the Monograph by Schumann (Hft. 11, Das Pflanzenreich, 1902), in Trop. Amer. Most of the plants cult. as marantas are calatheas; and the true marantas are treated the same as those plants. These plants are often named before the flowers are known, and some of the following plants may belong to the genus Calathea. The genus yields arrow-root (p. 397).

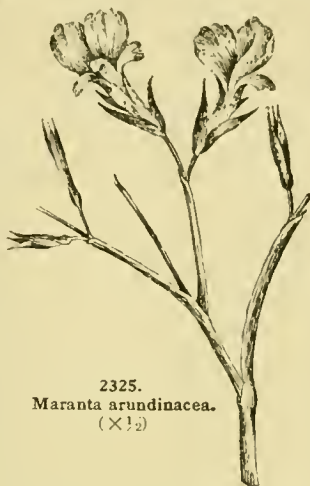
The culture of maranta is that of calathea, which is detailed in Vol. II, p. 619; but the directions may be reviewed from another experience. The marantas are grown for the handsome markings of the leaves, and for making complete foliage groups.—They are increased by division of the crowns, which may be accomplished just as they are starting into growth in the spring. Large plants are the best to use for cutting up, as they have strong crowns, and under proper treatment will form a plant more quickly. The loam should be washed from the root with a hose under gentle pressure. This gives an opportunity to see where is the best place in the crown for division. A sharp knife must be used to give a clean cut, which will heal more quickly. It is also a good plan to cover the cut part with powdered charcoal, which is a great help in the prevention of decay. The cut-up pieces may be potted in equal parts of the fiber of loam, flaky leaves, and sharp sand; add also a small part of broken charcoal.

The pot should be big enough to admit the roots without breaking or crushing them and they must be supplied with good drainage.—Marantas like abundance of moisture at their roots. The water, however, must pass freely through them, otherwise they soon get into a sour stagnant condition. Divided plants should be kept in a temperature of not less than 65° and the house must be kept in a humid condition by light syringing, and dampening between the pots on the bench, and in the paths. Change the air in the house by ventilating, as soon as the thermometer reaches 75°. Shade the plants from early spring until late autumn, as the bright sunshine will soon destroy the foliage and make the plants unsightly. Repotting is not necessary until the following spring.—In December, January and February, marantas may be allowed to get quite dry at the roots before watering. By this treatment they seem to start



2324. *Maranta arundinacea*. ($\times \frac{1}{2}$)

into a more vigorous growth, when they get a shift into a larger pot early in March. Established plants may be potted in a rather rough soil consisting of the fiber of loam two parts, flaky leaves one part, a small part of good sharp sand and another part of dried cow-manure. Add a sixth part of broken-up charcoal to the whole compost. Pot moderately firm, by pressure of the hands, and raise the crown a little in the center. In summer, admit plenty of air during the day, and leave a crack of top air on all night. This insures a strong healthy growth, and the plants may be used for decorative work, without suffering any damage. Tropical plants have been brought into disrepute by what may be termed the sweat-box treatment, which is entirely unnecessary. A soft flabby growth is the result of such usage. When in active growth, marantas may be watered with manure-water. Cow-manure water and soft-coal soot agree well with them. An ordinary handful to a 2½-gallon watering-pot will be found to be sufficient. Apply after watering twice with clean water. If marantas are well syringed under the leaves, insect pests are not troublesome. If they obtain a foothold, sponge the leaves with some reliable insecticide. (George F. Stewart.)



A. Lvs. green, pubescent beneath

arundinacea, Linn. Figs. 2324, 2325. Branched, 2-6 ft. high, tuberous; lvs. ovate-oblong to ovate-lanceolate and pointed, at the base rounded or truncate; fls. white in an open cluster, the upper lip roundish; staminodia surpassing corolla. Trop. Amer.; naturalized in S. Fla. B.M. 2307.—One of the sources of arrow-root, the plant being often called Bermuda arrow-root. The starch is obtained from the roots. It thrives along the Gulf coast, although little cult. There is a form with lvs. variegated green and yellow.

AA. Lvs. green, marked with strong parallel light-colored bars extending from midrib toward margin or with a whitish central stripe.

spléndida, Leri. Glabrous; lvs. 2 ft. or less long, the blade large, oblong-lanceolate, with base subcordate or somewhat cuneate, short-acute at apex, above shining dark green and marked with pale green transverse bars, beneath violet-red. Brazil. L.H. 13:467, 468.—By some regarded as *Calathea* (*C. splendida*, Regel), but its position is doubtful. Resembles *Calathea Veitchiana*, but more robust.

AAA. Lvs. blotched or banded with dark colors (sometimes contrasted with silvery colors).

leuconeura, Morr. Dwarf, the st. and lvs. about 1 ft. high, not tuberculate at base; lvs. oblong or broadly elliptic, usually obtuse or very short-acuminate, grayish green, white striped or banded along the veins, and marked with darker green, glaucous or purple beneath; outer staminode white, obovate and emarginate. Native in Brazil.

Var. **Massangeana**, Schum. (*M. Massangeana*, Morr. *M. bicolor* var. *Massangeana*, Hort.). Lvs. smaller, beautiful purple beneath; fls. somewhat smaller,

the sepals about ½ in. long; staminode deep violet, somewhat 3-lobed.

Var. **Kerchoveana**, Morr. (*M. Kerchoveana*, Hort.). Lvs. larger, glaucous or red-spotted beneath; fls. larger; staminode entire.

bicolor, Ker (*Calathea bicolor*, Steud.). A foot or so high, the st. tuberculate at base; lvs. linear-oblong or elliptic, rounded or subcordate at the base, more or less wavy on the margin, abruptly short-pointed, light purple below, pale glaucous green above, with a relatively light-colored central band and very dark green or brown-green blotches midway between the rib and the margins. Brazil. B.R. 786. L.B.C. 10:921.

See *Stromanthe* for *M. sanguinea*, *M. Porteana*.

See *Monotagma* for *M. smaragdina*.

See *Ctenanthe* for *M. Kummeriana*, *M. Luschnathiana*, *M. Oppenheimiana*, *M. setosa*.

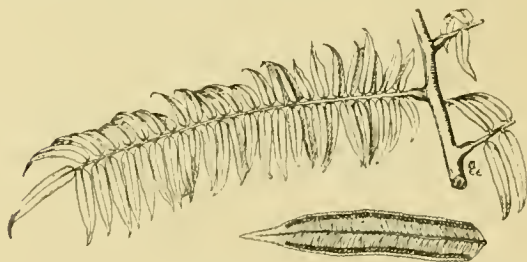
See *Ischnosiphon* for *M. bambusacea* (*M. bambuseifolia*?), *M. major*.

See *Calathea* (some of them in the supplementary list) for *M. Alberti*, *M. albo-lineata*, *M. argyrea*, *M. Bachemiana*, *M. Baraquinii*, *M. Chantrieri*, *M. chimboracensis*, *M. eximio*, *M. fasciata*, *M. fascinator*, *M. Gouletii*, *M. hieroglyphica*, *M. illustris*, *M. insignis*, *M. Lageriana*, *M. Legrelliana*, *M. leopardina*, *M. Lietzii*, *M. Lindtii*, *M. Makoyana*, *M. medio-picta*, *M. nicans*, *M. musacea*, *M. nitens*, *M. ornata*, *M. picta*, *M. princeps*, *M. pulchella*, *M. regalis*, *M. roseo-lineata*, *M. roseo-picta*, *M. Sanderiana*, *M. tigrina*, *M. tubispatha*, *M. Vandenheckei*, *M. Veitchiana*, *M. virginialis*, *M. vitata*, *M. Wagneri*, *M. Wollisii* (*Wollischii*), *M. Warszewiczii*, *M. Wiotii*, *M. zebrina*.

Other marantas with Latinized trade names are in recent lists, but not all of them are identifiable botanically. *M. amabilis*.—*M. argentea*, "large oblong silvery gray lvs., marked with narrow lines of green."—*M. bella*, Bull (*Calathea bella*, Regel, which is probably the correct name). Stemless; lvs. about 6 in. long, oblong, acutish, whitish green above, pale purple beneath.—*M. Clousonii*. Lvs. dark green, variegated with pale yellow. Brazil.—*M. Goveniana*.—*M. iconifera* (a form of *Calathea Makoyana*?), has lvs. about 6 in. long, obliquely oval, yellowish green, with oblong, deep green spots or bars. Brazil.—*M. Liebrechtsiana*. Lvs. large, oval, green, decorative. Congo. *Clingyone* (?).—*M. Lübersii*. Foliage reticulated with yellow.—*M. Lujaiana*. Lvs. handsome, long-stalked, purple beneath. *Halopegia* (?).—*M. mosella*.—*M. orbifolia*, "strong grower, olive-green with broad silvery bands."—*M. Sagoriana*. Dwarf; lvs. oblong, pale green, with oblong-oblique, deep green bars on each side of the midrib. S. Amer.—*M. Spitzeriana*.—*M. triumphans*.—*M. undulata*, Lind. & André (properly *Calathea undulata*, Regel). Six to 8 in. high, compact; lvs. ovate-oblong, the blade about 4 in. long, subcordate and unequal at base, very short-pointed, the surface undulate, beneath purplish, above deep shining green, with a whitish feathery stripe through the center. Peru. L.H. 19:98.

L. H. B.

MARATTIA (name from J. F. Maratti, an Italian botanist of the 17th century). *Marattiaceae*. A genus of large, coarse-lvd. stipulate tropical ferns with the large fleshy sporangia borne in boat-shaped groups on the under surface of the lf. The species are strong-growing and ornamental, some of them reaching considerable size. Besides the following, there are several American species which deserve cult. For cult. requirements, see *Angiopteris*, p. 1214.



2326. *Marattia fraxinea*. (X 1/8)

fraxinea, Smith (*M. elegans*, Endl.) Fig. 2326. St. erect, tuberous; lvs. bipinnate, 6-15 ft. long, the stalks often 1 in. or more thick; pinnales 4-6 in. long, 1½-1½ in. wide, of a leathery texture and naked surfaces; receptacles submarginal. W. Afr. to Malaysia and New Zeal.

M. Stanleyana, Hort., has not been sufficiently described to be identifiable.

L. M. UNDERWOOD.

MARCGRAVIA (Georg. Maregraaf, born 1610, a very early writer on Brazilian natural history). Sometimes spelled *Maregraavia* and *Maregrafia*. *Maregradiææ*; by some authorities included in *Ternstroemiææ*. Climbing epiphytic shrubs, one of which is offered abroad as a warmhouse plant: lvs. entire, short-stalked, coriaceous; fls. in terminal umbels or racemes, the corolla cap-like and falling as a single piece; sepals 6, 2 smaller; stamens mostly many (sometimes as few as 12); fr. globose to ovoid, more or less fleshy, with numerous seeds. Species probably 40, many of them recently described in *Trop. Amer.* *M. umbellata*, Linn., W. Indies and S. Amer., is a polymorphous plant, the sterile shoots creeping and rooting: lvs. on the rooting shoots distichous, nearly sessile, cordate and emarginate, on the other shoots oblong to linear: fls. greenish, umbellate; fr. with red pulp: clings to trees by roots.

MARCHANTIA (Marchant, French botanist). *Marchantiææ*. A common liverwort (one of the Bryophyta; see p. 6, Vol. I) spreading its lf.-like forking thallus on moist earth. *M. polymorpha*, Linn., has been offered by dealers in native plants, the sods of it being sold for colonizing in rock-gardens. It frequently grows on damp sills and walls in greenhouses. The flat thallus is often 4-5 in. long and 1 in. or more wide, from which rise peduncles 1 in. high, bearing the antheridial disk or shield and the star-like carpocephalum on similar stalks 1-3 in. high.

MARGUERITE, a popular name for certain daisy-like plants, the word related in origin to the Greek for *pearl*, as also *margaritaceous*, "pearly;" from the same root is derived the personal name Margaret and others. In florist's usage, the marguerites are species of *Chrysanthemum*. Blue marguerite is *Felicia anelloides*, and Reine marguerite of the French is the China aster. There are two types of marguerites, the common one, or Paris daisy, with coarse green foliage, and the glaucous marguerites, with finer cut glaucous foliage. The former, *Chrysanthemum frutescens*, is better for cut-flowers. The latter, *C. anethifolium*, is probably better for large specimens.

Marguerites are standard useful plants with florists and in the conservatories of amateurs, being of easy culture and remarkably free from enemies. They are cultivated for two distinct purposes,—for cut-flowers and for specimen plants, young plants being used for the former purpose, and older ones for the latter. For cut-flowers, the cuttings are rooted in spring, and the florists usually keep the plants in pots all summer outdoors, though this is not necessary for amateurs, and flowers are produced during the following winter. It is sometimes said that marguerites do not lift well in the fall after being planted out all summer in the garden, and that unrestricted root-room makes the plants too large for the best production of cut-flowers. The principles underlying the matter are as follows: In turning plants out of pots into the open ground in spring, a plant that has filled its pot well with roots tends to make a much more compact root-system in the garden than the plant that had but few roots in its pot, and the former plant is easily lifted in the fall and with less damage to the roots. As a matter of fact, marguerites do not belong to the class of plants that are difficult to lift in the fall, and it is only a question of starting the cuttings early enough in spring to get the plant moderately pot-bound before it is planted out into the open ground. Specimen plants are most attractive in the second winter following the spring in which cuttings were struck. After that they are likely to become too large and straggling. While in the garden, the flowers should not be allowed to form, if the main object is high-grade cut-flowers in quantity for the winter. Old plants that are unfit for further use in the conservatory may be turned out in summer and will

furnish scattering bloom all summer, though the flowers are likely to be rather small. If there were sufficient demand, it could be easily managed to have flowers in every month of the year. It is a great pity to cut marguerites without any foliage. The rule is that all flowers look best with some foliage, especially their own. With a little forethought, just as many flowers can be secured, and they will look much prettier and last longer. There are very few conservatories without some marguerites. An excellent plan is to have a number of plants in 6-inch pots from cuttings struck the previous spring. A plant looks bad at first when the flowers have been removed on sprays a foot long, but in a short time they are ready for cutting again. With a little management, a succession of flowers can be maintained without making all the plants thin or unsightly. Such sprays will last a week or two in water, and the opening of the larger buds is an additional feature of beauty which is lost if flowers are cut with short stems and without foliage. (Robert Shore.)

MARGYRICARPUS (Greek, *pearly fruit*; referring to the white berries). *Rosææ*. South American subshrubs, of which *M. scotus* is a heath-like plant cult. in rockeries for its numerous small white berries, which are seen to best advantage against dark background. The nearest genus of garden value is *Acaena*, which has fls. on heads or spikes, while those of *Margyricarpus* are solitary and axillary. Branching shrubs with inconspicuous fls. which are sessile and have no petals: lvs. alternate, crowded, overlapping; calyx-tube persistent; lobes 4-5; ovary 1, in the calyx-tube, with very short style; ovule solitary, hanging from the top of the cell: fr. a coriaceous achene.—Species a half-dozen and more, in temperate parts of mountains and south to Patagonia.

setosus, Ruiz. & Pav. **PEARL FRUIT**. Low-growing little evergreen (about 1 ft.): lvs. odd-pinnate with subulate more or less reflexed lfts.: fls. very small, green, sessile in the axils: fr. white, showy and persisting for some time, small. Peru, Chile.—Hardy in England. Intro. in S. Calif.

M. hybridus is offered abroad as a "pretty evergreen alpine shrub thickly studded with rose-colored berries." L. H. B.

MARICA (meaning doubtful; perhaps from the verb *to flag*). *Iridææ*. Tropical plants allied to *Iris*, but with shorter-lived flowers and convolute inner segments.

Rootstock a short rhizome: lvs. sword-shaped, 2-ranked: fls. blue, yellow or white, very fugitive, in clusters on a flat and lf.-like peduncle, 2-4 in. across, the outer segms. large, white or blue, the inner ones smaller, fiddle-shaped, with beautiful coloring; stamens short and erect, the filaments distinct: caps. oblong, 3-valved, many-seeded.—About a dozen perennial herbs, in *Trop. Amer.* and 1 in Guinea (Afr.) They are planted in the fall, and are hardy with winter covering in the warmer parts. The genus is nearest to *Cypella*, but the style-crests are petal-like, while in *Cypella* they are spur-like or flattened; in *Cypella* the lvs. are plicate rather than distichous and the rootstock is bulbous.

A. Outer segms. white, or marked at the base with brown and yellow.

gracilis, Herb. Lvs. 6-8 in a tuft, sword-shaped, 1-1½ ft. long, ½-1 in. broad: peduncle long and flat, bearing fls. at some distance from the end and sometimes taking root from the top; fls. 2 in. across; outer segms. obovate, white, with cross-marks at base of yellow and brown; inner segms. small, reflexed, blue. Mex. to Brazil. B.M. 3713. Gn. 63, p. 37.

Northiana, Ker. Lvs. about 8 in a tuft, sword-shaped, bright green, about 2 ft. long and 1½-2 in. broad: peduncle 3 ft. long, as broad as the lvs., with about 2 clusters near the apex; fls. 3-4 in. across; outer segms. pure white and obovate, variegated on the claw;

inner segms. with violet tip and variegated claw. B.M. 654. I.II. 42:40 (var. *splendens*). Gt. 61, p. 91. G.L. 26:137. Gn. 65, p. 289. F.S.R. 3:52.—Handsome; a good subject for a basket.

AA. *Outer segms. blue.*

cærulea, Ker. Lvs. 6-8, sword-shaped, 1-1½ in. broad and 2-3 ft. long; peduncle long, as broad as the lvs., bearing 2-4 fl.-clusters: spathes 2-3 in. long, the outer valves green and lanceolate: fls. 3-4 in. across, bright blue or lilac, the outer segms. 1-1½ in. across and variegated at base with transverse bars of yellow, white or brown, the inner segms. with recurved blue point. Brazil. The African *M. Sabini*, Lindl., Baker considers to be probably only a form of *M. cærulea*, and intro. into Upper and Lower Guinea. B.M. 5612 (as *Cypella cærulea*). B.R. 713. Gn. 25, p. 313; 33:56. J.II. III. 49:17.

Helenæ, Worsley. Related to *M. cærulea*: fls. nearly 5 in. across, blue and white, on long lf.-like scapes: drooping segms. or "falls" much longer than in *M. cærulea*, somewhat narrower, indigo-blue, the reflexed apices measuring 2½ in. long; standards much more distinctly vittate, deep velvet-blue in 2 marginal stripes with a keel of white of equal width between them; plant also hardier, withstanding some frost. Brazil.

L. II. B.

MARIGOLD. The original kind is the pot marigold, the dried flowers of which are used to season soups. It is also cultivated for ornament. See *Calendula officinalis*. The French Marigold is *Tagetes patula*; the African, *T. erecta*. The African marigolds are mostly pure lemon- or orange-colored; the French ones have these colors and brown also, and are often striped. For Cape M. see *Dimorphotheca*. For Fig M. see *Mesembryanthemum*. Marsh M. is *Caltha palustris*.

MARIPOSA LILY: *Calochortus*.

MARIPOSA TULIP: *Calochortus*.

MARJORAM, SWEET: *Origanum*.

MARKET-GARDENING is the growing of vegetables for commercial purposes by the employment of the most skilful methods. It is one of the most intensive types of vegetable-gardening. Land values, where market-gardening is practised, are usually high, and it is necessary to secure large returns to the acre in order to realize a profit on the investment. The crops which receive most consideration by market-gardeners are beets, onions, celery, lettuce, radish, carrot, parsley, endive, and other vegetables which are usually planted close together and cultivated with hand wheel-hoes.

Truck-gardening, or truck-farming, is the growing of vegetables for market by the employment of extensive methods. Less intensive methods are followed in truck-gardening than in market-gardening. Land values are lower and it is unnecessary to obtain large cash returns to the acre in order to make the business profitable. The trucker relies mainly on such crops as the cabbage, tomato, sweet corn, asparagus, pea, bean, cucumber, watermelon, muskmelon, sweet potato, and other crops which require liberal spacing and which are usually cultivated by horse-power.

Market-gardeners are usually located near the towns or cities in which the vegetables are sold, although there are exceptions; truckers, as a rule, are remote from market. The best examples, and the most extensive areas, of market-gardeners are near the large cities—New York, Philadelphia, Boston, Chicago, Baltimore, Washington, San Francisco, Toronto, and Quebec.

Vegetable-forcing is the growing of vegetables under glass, or canvas, or in specially constructed houses which are heated by artificial means.

In choosing a location for market-gardening, too

much attention cannot be given to the market demands of the locality and how fully they are met by growers already operating in the community. There should be the best of roads and of transportation facilities to the markets to be supplied. Liberal supplies of stable-manure should be easily obtainable at reasonable prices. A sandy soil is a distinct advantage; it is easily cultivated, and with good management produces vegetables of the highest quality early in the season. On account of the uncertainty of an ample supply of rain throughout the season, crop-production will be made more certain and profitable by irrigation, and there should be no shortage in the water-supply. An abundance of pure water will also be needed in preparing the vegetables for market. The supply of labor should also be taken into account in the choice of a location.

High fertility of the soil is a prime factor in the successful operation of a market-garden. The land must be in the proper physical condition if crop-yields are to be satisfactory. Available plant-food must be present in adequate quantity throughout the growing season. Stable-manures are universally applied in large amounts by market-gardeners. It is not uncommon to apply forty or more tons to the acre. Such large applications annually increase the percentage of organic matter in the soil, thus providing the best physical, chemical, and bacteriological conditions for plant growth. While many gardeners rely wholly upon stable-manures as a source of plant-food, others find it profitable to employ commercial fertilizers, varying in amount from a few hundred pounds to two tons to the acre. Complete fertilizers are generally employed, and they usually contain about 4 per cent of nitrogen and from 7 to 10 per cent of each of the mineral elements—potash and phosphoric acid. Lime is often used to make heavy soils more friable, to prevent the ravages of club-root, and to maintain an alkaline condition in the soil, which is important from the standpoint of avoiding mal-nutrition diseases.

Market-gardeners usually do not attempt to cultivate large tracts of land. Occasionally, a man will handle 50 to 75 acres, but most of the growers have less than 25 acres and thousands of them less than 10 acres. By the employment of the most intensive methods, a living may be made on 2 or 3 acres, although most gardeners will do better on a larger area. Small areas require the use of more glass, in the way of hotbeds and coldframes or perhaps greenhouses.

Inasmuch as a livelihood must be made from a small area of land, it is necessary to keep every foot or inch of the place occupied with a crop throughout the growing season. The first crops are started early in the spring, just as soon as the ground is dry enough to work, and they follow each other in close succession until late in the fall. By skilful management, it is possible to grow four or five crops on the same land in one season. Companion-cropping is common among market-gardeners, and, in order to make the soil do its maximum duty, one crop is often planted before the preceding one is harvested. For example, immediately after the last wheel-hoe cultivation of beets, planted in rows a foot apart, rows of lettuce may be drilled midway between the beets. When the lettuce is about ready to harvest, carrots may be drilled between the rows, and these may be followed by some other small crop, and so on until late autumn. When companion-cropping is practised, it is important to have straight rows, so that there will be uniformity in the spacing between the rows. This is essential if wheel-hoes are to be used in the most effective manner, and straight rows also make a more attractive garden.

The greatest variety of companion-cropping plans may be practised. The following plan, with C representing cabbage, L, lettuce, and R, radish, shows the possibilities of this system:

C	1	C	1	C	1	C
$\frac{1}{2}$						
			Radish			
$\frac{1}{2}$						
1	1	1	1	1	1	1
			Radish			
C	1	C	1	C	1	C

In considering intercropping plans, the gardener should be well informed concerning the requirements of each crop,—its habit of growth, soil-adaptation, space-requirement, susceptibility to disease and insect depredations, time of maturing, and the like.

The outlook for market-gardening in America was never more encouraging than at the present time. Great advances in prices need not be expected, but the rising prices of meats will unquestionably favorably influence the market for vegetables. Our markets are demanding the highest quality of vegetables, and every gardener should attempt to grow the best and to place it on the market in the most attractive condition. Profits in market-gardening depend quite as much upon the grower's ability as a market-man as upon his skill in production.

R. L. WATTS.

MARKETING OF HORTICULTURAL PRODUCE. The growing and disposing of horticultural products have from earliest times been bound together. Within the past decade, the tendency to dissolve the marketing from the production has been developing very perceptibly. This division of labor has doubtless been due to the rapid increase in the amount of detail and skill required to do both producing and marketing successfully.

The business of disposing of horticultural products is now somewhat specialized and follows fairly well-defined lines. These may be described as (1) marketing directly to the consumer; (2) marketing indirectly or through middlemen of the many and various kinds; (3) marketing through coöperative associations.

Marketing directly to the consumer.

By this is meant sending the produce directly from the producing region. This is the simplest, easiest and most satisfactory of all ways. The producer, in this way, receives the best returns for his crop, and the consumer secures the produce for the most reasonable price and without the delays between harvesting and selling which very often cause serious deterioration. Many fruit- and vegetable-growers have worked up a satisfactory business by disposing of their products in this way. This is usually initiated by friends of one or both parties and later supplemented by cards inclosed in the package and by advertisements. It is a fairly common practice for fruit-growers to sell directly to an association of farmers in a grain or dairy region. A personal confidence between the grower and the consumer develops from this method of dealing, and so long as neither side destroys this confidence the customer becomes an advertising agent for the grower.

It was thought that the parcels-post system would stimulate direct selling. It has been practised to some extent, but there seems to be no very immediate likelihood that it will become a large factor for bringing the horticultural producer and consumer together. So many horticultural products are of a highly perishable nature, while many of a less perishable nature are too bulky.

In some cities, marketing directly to the consumer is done through city public markets, with satisfactory results to the producer and the consumer. These marketing centers are usually constructed by the cities, and for a small fee the farmers, gardeners and fruit-growers rent stalls or stands. Rules and regulations for the conduct of the business of selling are usually pre-

scribed by the city government, and they are enforced by the superintendent of markets or other official in charge. The market is opened and closed and selling is active at designated hours. Usually all sales are made for cash and the buyer carries home all produce purchased. This marketing brings closely together, to their mutual benefit, the producer and consumer. As the overhead expenses of marketing are reduced to a minimum, the public markets have been important factors in reducing the cost of living in many communities.

Marketing indirectly or through middlemen.

A large part of the horticultural products are sold by the grower to jobbers, dealers and retail merchants. This is the next step in the evolution from direct selling. Much harsh criticism has been applied to the middleman; however, there can be no doubt but that he has an important place in the disposition and distribution of horticultural products. The marketing and distributing has rapidly become such an intricate, extensive and specialized business of itself that few fruit-growers can afford the time or have the business training or skill required to do this work well.

There undoubtedly always will be a place for the middleman in the distribution of produce so long as many kinds, grades and varieties of products similar in a general way are grown on small farms and sent to distant markets to be sold.

The middleman is, in reality, a distributor. It would be impossible for the men who grow the crop to place or distribute it in markets over the country so that it might be purchased at a reasonable price in many regions, and not permitted to accumulate in too large quantities in some markets while in others there would be a scarcity or nothing. Horticultural products are, in a large number of cases, highly perishable and markets must be provided some time in advance of the ripening of the crop. This requires capital, familiarity with trade in many sections, confidence, good-will, and wide acquaintance with the many outlets.

The general term "middleman" may include buyers, commission men, jobbers, dealers, brokers, auction companies, solicitors, speculators and distributing agencies.

(a) Buyers and jobbers.

The term "buyer" in the mind of the truck- or fruit-grower, in most producing sections, is any individual who is located at the shipping-stations and endeavors to buy produce from the grower as it is brought in from the gardens and farms. These buyers may be operating the business for themselves, endeavoring to "get together" a carload of mixed or similar products to be shipped or consigned to the market. They may be representatives of a jobbing or commission company, working on a salary or commission on the business accomplished. It is their entire purpose to buy the highest grade and best packed products at the lowest price that the grower will take for them. These buyers may buy one or several kinds of produce but usually they want but one kind and one grade. These men make a special business of buying one kind of produce at a time and many of them "follow the crop," i. e., begin in the southern states to buy when the crop is harvested and move north as the later crops are ready for market. This applies especially to strawberries, potatoes, peaches, and tomatoes. They do not have an office or permanent location and may or may not return to the same place season after season.

Carlot purchasers are classified as "jobbers." They usually have a permanent location, an office, scales, and other equipment and return season after season to the same place. This is especially true in some of the important potato-growing sections.

Some jobbers have a warehouse or store in the city and do a general fruit and produce business through the

store, or by handling direct shipments from the producing center to the market.

(b) *Broker.*

The term "broker" is commonly applied to that class of middlemen who may buy supplies from shippers, commission men, or at auctions in the quantity and grade they desire and immediately resell it to retailers in small lots. A broker may have a business along a definite line, as citrus fruits or apples, developed in a section of a large city, and keep in close touch with the needs of his customers (usually men doing a small and mixed business and very frequently foreigners not familiar with the English language) and supply them from day to day. Frequently these men do a large business without an office or permanent headquarters or any equipment. They know each morning the needs of their customers for the day; and accordingly, buy the goods in large quantities, which are delivered directly from the purchasing-point to the retail dealer. The difference in the large-lot buying price and the small-lot selling price becomes the broker's profit.

(c) *Commission men.*

The field occupied by "commission men" in the produce trade is well defined and understood. It is an important one, and they are real factors in the distribution of produce of all kinds. The commission man, firm or company, has permanent headquarters in the produce-selling neighborhoods of the city, usually a store and necessary equipment, and rent cold-storage space as their needs require. They advertise and have agents or solicitors located in the producing regions to induce the growers to ship to them all or only one kind of any produce they may grow, as fruit, vegetables, butter, eggs, and poultry. This is usually sold very shortly after it is received to customers who may be brokers or large consumers, as hotels; but usually they are proprietors of groceries, fruit-stores, or -stands. Such a method makes it necessary for the commission firm to keep in close communication with the two great classes, the growers and the consumers. They are in reality a go-between or connecting link between these two classes. They have, as a class, received for a long time very severe criticism for making false reports upon the condition of produce on its arrival to them and also for making untrue returns to the grower, but these instances are no different from those that probably exist in many other lines of business. There are many honest commission firms that have been very important factors in assisting growers to build up a profitable business. The grower must do his part honestly to give the commission man a chance, and the seller must work for the interest of his shippers. Sincere coöperation is necessary upon both sides. The best results have been obtained in cases where an honest, fair-minded grower has coöperated with an honest commission dealer over a series of years. If the grower packs his produce in a uniform way and gives the dealer the opportunity to develop a class of trade for that particular grade and to know about what he can depend upon receiving, he can secure and hold permanent customers.

The grower may very materially coöperate with the commission man and assist him to secure better prices if he adopts and consistently uses an attractive label on packages of superior produce. Buyers of all classes quickly learn to what extent they can depend upon a labeled or trade-marked package. Thousands of packages of fruits, oranges and lemons especially, are sold entirely upon the reputation behind the label upon the end of the box. A label once adopted and honestly used by a grower should not be changed or altered in any way; if so, any accumulated benefit will be quickly lost. It must be understood that large quantities of produce are sold to persons who cannot read the Eng-

lish language but will remember a picture or design in connection with a grade of produce.

Immediately after the produce is sold, the returns are made to the grower, accompanied with a statement showing the selling price, the commission for making the sale, the transportation, cartage, storage and other shipping expenses deducted.

(d) *Dealers.*

A group of men to be found in the produce trade may be classed as straight buyers or dealers. They are not so numerous as commission men, but in some lines of produce-handling are very important factors. These dealers usually buy produce direct and outright from the growers. It may be immediately sold, but it is frequently stored, and sold to the regular customers of the dealer. This type of marketing produce is often somewhat limited to such staples as apples, potatoes or onions, but may include the shorter-lived commodities as berries, peaches and green vegetables. It is straight direct dealing upon the part of the producer and the dealer. The producer knows exactly how much he will receive for the quantity of produce he has and the dealer knows the price he must charge his customers. It is the business of the dealer to keep well informed upon crop conditions and prospects in all parts of the country for the commodity he is specializing in, or those that may compete with it, and to keep the needs of his customers supplied with a grade of produce their trade demands.

Many growers have enjoyed such business relations with dealers over long periods of years, both parties coöperating and keeping in close touch with each other, resulting in their mutual good.

(e) *Auctions.*

In many of the larger cities, great quantities of produce are sold by auction. Companies may be organized by several men engaged in the general produce trade; by a group of producers; by a group of buyers; or they may be formed by independent companies. The charge for making the sale is a percentage upon the gross receipts and is not often more than 5 per cent, frequently less. These auctions are, in most cases, located in the large distributing centers, but in a few instances they are located at the producing region.

The large quantities of fruits and vegetables imported into the country are nearly all sold through the auctions, as are many of the products from the Pacific coast and other western regions; also from Florida and some other regions where products of one kind are extensively produced. Auction selling is a very rapid way of moving large quantities of produce in a short time. Frequently as many as fifty carloads are sold in a few hours.

Produce may be sent to the auction company by carlot growers, shippers, buyers, dealers, associations, or other receivers. It is purchased by men whose business it is to buy for large stores or chains of stores, brokers, or large consumers.

The auction company controls a warehouse where the produce to be sold is displayed; an auction- or sales-room where the actual selling is done, and offices. A list or manifest of the contents of the carload to be sold is forwarded by the shipper to the auction company and received some days in advance of the car. The cars are unloaded during the night and the produce systematically arranged in "lines;" i.e., citrus fruits, all of one variety, brand, and size are placed in a separate pile. The top package is opened for inspection. At a definite time, the wareroom is opened to buyers to permit an inspection of the produce before selling begins. Each buyer is provided with a list or catalogue which is compiled by the auction company from the car manifests received in advance, and contains a list and brief description of the produce to be offered for sale.

The following page from a fruit auction catalogue (reduced in size) will require some explanations:

LINES	MARKS	DESCRIPTION
Ontario Cucamonga Fruit Ex.		CAL. FRUIT-GROWERS' EX. D. D. Black, Dist. Mgr. S. F. R. D. Car H191 Upland Ventilated Lemons
355	240	8 Jumbos
356	270	13
357	300	1
358	300	148 Boxes
359	360	68
360		
361	Monogram Brand (Red Ball) 240	1 Jumbos
362	270	5
363	300	67 Boxes
364	360	25
365		

The heavy figures to the left indicate the "lines," and each "line" means a certain number of packages which are grouped by themselves in the warehouse and marked with a large chalk-mark on the floor in front of the pile, this number on the floor corresponding to the "line" number in the catalogue. The name and small label appearing under "lines," and "marks" correspond to those upon the packages and serve to assist buyers who are not familiar with the English language in identifying the fruit and catalogue description. In the column "marks" is given the size of the package or the number of fruits it contains; under "description," by whom it is shipped, the car number, and under what shipping conditions. (In this case "ventilated;" it might have been "iced" or "precooled.") This is important to the buyer as often the conditions under which the fruit has been shipped may be closely related to its condition, appearance, and subsequent keeping quality.

The blank spaces in the "description" column are used by the buyers to make memoranda on the condition, grade, and value, and used for reference as the selling proceeds.

At a definite time, the buyers assemble in the auction-room. The auctioneer announces any corrections to the catalogue which may be necessary and opens the whole page for sale, and the highest bidder may take his choice of any "line" or "lines" on the page. As these are sold, each man scratches them off, and the remainder of the page is then thrown open for bids. The buyer who bids highest will choose the best "line" or "lines" on the page. The selling is started again and the highest bidder takes the best remaining "line," and this continues until the page is sold. Usually the rules of the auction company require sales of not less than ten large or twenty small packages unless the number in the line may be less.

(f) Local auctions.

Produce is sometimes sold by ordinary auction at the shipping station. This local auction method, as it may be designated, became an important method in marketing peaches in the Catawba Island district of Ohio. It is reported to have originated with an attorney, as he observed the amount of time unnecessarily consumed by the buyers and growers trying to complete sales.

The method is simple and rapid. As the growers arrive at the shipping-stations, they line up their loads in order of arrival. The buyers stand upon a platform and inspect the fruit of each load as it comes to them and the auctioneer conducts the sale. The fruit is then delivered to the car, checked over and paid for by the buyer. The auctioneer's fee is paid by the grower. The extensive growers may load their own cars which would be sold in the same way, often bringing an extra price.

This system made it possible for the buyer to secure the variety and grade of fruit he desired and he could, in this way, more easily buy a carload that would be of uniform quality, or of any grade he wanted. The grower who had a superior grade of fruit or especially well packed would have it selected from the average run, and in this way might secure a better price. Sales could be made quickly and the time of the grower saved in a very busy season of the year. Combines of the buyers to hold the price down were possible, but could be broken by the growers refusing to sell on the auction and shipping the fruit themselves to commission men.

The method has recently been superseded in the Ohio peach-growing district by local coöperative associations that are successfully serving the needs of the growers.

(g) Distributing agency.

Within the past few years, the problem of distributing the large crops of produce has presented itself with increasing importance. Heavy crops of high quality fruits and vegetables have been successfully grown, but the task of getting them distributed to the consumer in a sound wholesome condition at a reasonable price has been the greatest problem. All of the usual ways of marketing have been used, but additional ways have been devised and have come into practice.

There are several types of distributing companies or agencies and newer ones are continually being devised, formed, and put into operation. One type is for several coöperative associations to unite and hire a salesman to assist their manager to get in communication with a large number of markets and consuming centers and in this way secure a wide distribution for the produce.

One type of distributing agency may be described as a company that receives earlot shipments of various kinds of produce from any point in the country, but especially from local coöperative growers' associations, and sells it through its selling agents who are located in all of the important markets in the country, but managed from one or two central offices. It is possible, under such a system, to secure a more even and desirable distribution of produce as the local selling agents

keep in close communication with the main office. In the shipping season, the agency will have representatives at the shipping stations to assemble, inspect and forward the carlots upon telegraphic advice from the main office, who in turn are advised daily as to the general market conditions and prospects by the selling agency.

Shipments started from the producing center to a certain selling market may be diverted to some other market upon instructions received from the central office, and in this way an over or an under supply in any market may be avoided. After the sales are completed, the returns are rendered to the grower through the shipping agents.

Such a distributing system effectively and honestly operated will relieve the grower and local coöperative association of the difficulty and expense of marketing their crops, giving them their entire time for the details of the production and packing. A large force of capable selling agents to study the needs of many local markets should be competent to assist in distributing large quantities of produce in an efficient way.

Coöperative associations.

Groups of fruit- and vegetable-growers have formed coöperative associations with the idea of securing better results by working together in the packing, shipping and selling of their products rather than by operating independently.

The coöperative idea and spirit were first and most highly developed among the fruit-growers on the Pacific coast and other western regions. This may be accounted for because of the distance from the greatest consuming centers, making large shipments necessary from the standpoint of economy; the general uniformity of the crops grown, and the fact that many growers depend entirely upon one or two specific kinds of crops for their income; and possibly that the western growers might have been quicker to see the advantages of such a scheme of marketing.

Without question, more coöperative associations of fruit- and vegetable-growers have resulted in failures than successes, but the spirit of coöperation is strong and may be said to be growing, and the mistakes of the past are used to guide the future.

A coöperative association should be a non-profit organization. Membership should be open only to actual producers, and when a member ceases to be a producer he ought to be required to dispose of his share in the association. Many organizations, standing under the name of coöperative associations, are in reality owned and managed by a few men (not always growers) exclusively for profit.

The organization of a coöperative association adapted to the requirements of a body of fruit- or vegetable-growers is not elaborate nor difficult. The growers who desire to form an association may assemble and, after choosing officers and a board of directors (frequently five) from among their own number, are ready to select a name for the organization, adopt a constitution and by-laws and make rules and regulations respecting the management of the association. Contracts should be made between the association and every member, and all obligations upon both sides specified. Membership certificates or shares of stock are sold and the voting power of the members arranged. This may be the same for each member, but sometimes is based upon the acreage of the member's crop, or the quantity of produce shipped by him the previous season.

The board of directors hire a general manager, usually upon a stated salary, but in some cases for a percentage of the gross receipts, or in a few cases, the number of packages handled. His chief duty is to look after details and enforce the regulations adopted by the association. The board of directors usually decide upon the ways of grading, packing, shipping, names of

brands and such matters (often methods of harvesting and time of harvesting). It is thought that this will lead to uniformity and attractiveness in the packed product.

The details of the management may vary with the aim of the members and officers, the locality and the commodity handled. There may or may not be a central packing-house where the fruit of the members is delivered for inspection, grading and packing. With some fruits, as citrus, it may be imperative, but with highly perishable fruits, as strawberries, it may be very undesirable. Without a central packing-house, packing must be done in the field by each member, but more efficient inspection and grading is possible at a central packing-house, and the result is that a more uniform product can be prepared. When the packing is done in the field by the individual members, the inspection must be done by an inspector hired by the association and under the direction of the general manager or board of directors. He usually does this work at the loading-station, and obviously cannot do as thorough work as could be done at the central packing-house. In some associations the inspectors give demonstrations and instructions to the members before the crop is ready to harvest. When this is done, the requirements and desires of the association are better understood by the individual. This practice is especially valuable at the beginning of a new organization, or among new members.

After the produce is properly packed and loaded into suitable cars, it is forwarded to the marketing point. The selling may be accomplished through agents employed by the association or be turned over to a commission firm, a distributing agency or sold to a dealer or consumer. Returns are made to the grower upon the pro rata basis known as "pools." The price received for all of the same kinds of produce shipped within the specified time, a day, week, two weeks, month or season, is "pooled." The operating expenses are deducted and the remainder divided upon the basis of the amount of each grade or brand of produce contributed by each member. Differences and dissatisfactions may arise over the "pool" system among the growers. The produce of one member may be sold in Minneapolis at a much better price than was realized from the produce of his fellow member in St. Louis.

In addition to the advantages that may be secured by disposing of produce through a successful coöperative association, is the large and important feature of the possibility of the management buying many supplies needed by the association members in large quantities, selling them to the members without profit. The saving thus secured on some supplies and in some regions is considerable and a strong argument in favor of a coöperative organization.

The reader who is specially interested in these associations, should secure from them copies of their constitutions and by-laws. These documents are now published, as examples, in many reports and books.

(a) A California organization.

The California Fruit-Growers' Exchange is the largest and most highly developed coöperative association of fruit-growers probably in the world. The form of organization is interesting and unique. About 12,000 fruit-growers of California are engaged in the production of citrous fruits and over 60 per cent are members of the California Fruit-Growers' Exchange,—a coöperative organization to provide facilities for these growers to distribute and market their fruit. There are three distinct divisions to the organization: (1) the local exchange; (2) the district exchange; (3) the central exchange. Each division has a clearly defined function and all are intimately related.

The local exchange.—There are about 150 of these local associations or exchanges located in the growing

regions. They are non-profit corporations organized under the laws of California. Stock is issued to each member in proportion to his bearing acreage, to the number of boxes he ships, or in equal amount to each grower. The management is in the hands of a board of directors chosen from among the growers. A packing-house is owned or leased and properly equipped. No profits are accumulated nor dividends declared.

As the fruit is assembled in the packing-house, that of each member is kept separated until it is inspected and graded, which gives a basis for making the returns upon the "pool" system. An association may market any part of the crop at any time during the picking season they desire and, in some cases, this privilege is extended to the individual members.

The length of the "pool," whether a week or a month, depends upon the desires of the association. Each association has a brand name for each grade of its fruit, and this name and label is the exclusive property of the association. When a carload is ready for shipment, it is marketed through the "district exchange" of which the local association is a member.

The district exchange.—The local exchanges are federated into seventeen district exchanges, which are non-profit corporations. There may be one or more in a community, depending upon local conditions. Their function is to act as a clearing-house in marketing the fruit for the local exchanges through the California Fruit-Growers' Exchange and to act as a medium through which most of the business relations between the Exchange and local associations are handled.

The district exchange officers order the cars from the railroad and see that they are placed at the various local exchange packing-houses. They keep a record of the cars shipped by each local association, with their destination, and receive the money from sales through the head office and turn it over to the local exchanges. Other functions are to keep the growers informed through the head office of all phases of the citrus marketing business, and place this information before the local associations, where in turn it is passed on to the growers, and return the proceeds to the associations.

The central exchange.—The California Fruit-Growers' Exchange is a non-profit corporation formed by the seventeen district exchanges and managed by a board of seventeen directors, one from each district exchange. The headquarters is in Los Angeles. Its function is to furnish marketing facilities for the district exchanges at a pro rata share of the cost. The directors hire a general manager and assistants. Bonded sales agents for the principal markets of the United States and Canada are appointed and managed from this office. Telegraphic advice is received every day from these agents of the sale of each car, together with information on the conditions and prospects of the market. This information is sent daily in a bulletin form to the local associations. The business is on a cash basis and prompt accounting returns are made to the growers through the district exchange. Other functions are the attention to any litigation that may arise in connection with the marketing of fruit, handling all claims, conducting an advertising campaign and endeavoring to develop new markets. This work is supported by levying an assessment against each district exchange for the pro rata share of the expenses on a basis of the number of boxes shipped. In the Exchange, every shipper reserves the right to regulate and control his own shipments, to develop his own brands of fruit, to use his own judgment as to when and in what manner it shall be shipped and to what markets it shall be shipped, and the price he is willing to receive; reserving the right of free competition with all other shipments including the members of the same organization.

Membership in the Exchange is voluntary. A grower may withdraw from a local association at the end of the

year; the local association may withdraw from the district exchange, and the district exchange may withdraw from the central exchange. One-third of the entire shipments are sold at public auction and the remainder through unrestricted private competition. There is no uniformity in price of the different brands.

The Exchange is organized in several divisions: Sales, Legal, Traffic, Advertising, Field, Insurance and Mutual Protection, and a Supply Department which furnishes materials used in packing-houses and groves at cost to members.

(b) *A Canadian organization.*

As the California Fruit-Growers' Exchange is the largest agricultural coöperation for marketing purposes in the United States, so the United Fruit Companies of Nova Scotia is a prominent example of successful coöperation by Canadian apple-growers. This company is located in the famous Annapolis Valley apple region of Nova Scotia. There are forty-eight coöperative companies in this Valley; forty are federated into a central association, which is incorporated under the name of the "United Fruit Companies of Nova Scotia, Limited." The membership of the subsidiary companies varies from ten to one hundred twenty, the average being about forty. Each company owns a warehouse or central packing-house where the fruit must be packed by experts under the direction of the company manager and an inspector sent from the central office, who has the authority to order repacking, if in his judgment it is necessary. Orchard- or home-packing by the individual members is not permitted. It is the business of each company manager to become acquainted with each member and with the type and grade of fruit he is growing. Before picking, the manager sends to the central office an estimate of the crop of his members and its condition. Pickers may be sent from the central office to assist the local growers. The picking and hauling is done under the direction of the local company manager. This rule has been found desirable to prevent large quantities of fruit from being delivered at the central packing-house unexpectedly. Fall apples may be hauled to the packing-house in unheaded barrels, as they are usually packed at once; but winter apples are delivered in tight barrels. Every barrel has the growers' name marked upon the side and a receipt is given for the quantity and variety delivered. The deliveries of every day are recorded in a book in which one or more pages are assigned to each member. On the left side are the series of columns, one for each variety, under which is recorded the date and number of barrels delivered. On the right page is a record of how these apples were graded or "packed out."

The business of marketing the entire output of all the subsidiary companies is performed from the central office, which is at Berwick. This office maintains and directs an organized force of salesmen. European sales are conducted through the London office and the South American business through the Buenos Ayres office. The apples of all the local companies are pooled and the returns made to all upon the average selling price of each grade of each variety.

Some of the advantages to the growers that have been brought about by the coöperation, in addition to better prices, are the convenience of an improved type of box-car especially adapted for shipping apples in extremely cold weather, and a shorter shipping time for transatlantic shipping, and better boats.

Coöperative buying is an important function of the association. The central office makes large purchases of supplies directly from the manufacturers, thus securing the lowest price, as all the cost of selling, bad debts and other expenses are eliminated. The supplies are shipped in earlots directly to the central packing-houses of the local companies and, upon arrival, the members are advised and come with their teams to haul home the

goods they ordered. In 1914, over 300 carloads of fertilizers were purchased at a saving of \$18,000 to the members; large quantities of other supplies were purchased, as pulp, heads, nails, grass, clover, vetch and oat seed, flour, feed, arsenate of lead, wire fence, lime-sulfur and tobacco sulfate.

As a further coöperative function, the central office handles all of the fire insurance business of the subsidiary companies of insuring the packing-houses and contents, thus saving the commission previously paid to agents. A weekly newspaper called the "Coöperative News" is published from the central office.

The total selling expenses in 1914 were exactly 4 cents a barrel, or $1\frac{1}{2}$ per cent on the volume of business.

For discussions of methods of sorting, grading and boxing fruits and other products, see the article *Pack-ing*, Vol. V.

H. J. EUSTACE.

MARKHÂMIA (after C. R. Markham, who intro. the Cinchonas into India). *Bignoniaceæ*. A genus of 10 African and 2 Asiatic tropical evergreen trees or shrubs with large opposite odd-pinnate lvs. usually with pseudostipules in the axils, glabrous or pubescent; fls. in large terminal or axillary panicles; calyx spathe-like, splitting on one side; corolla tubular-funnelform, usually yellow with red or purple stripes inside; stamens 4, included, with spreading anther-cells; ovary with 4 rows of ovules in each cell; caps. linear, loculicidally dehiscent into 2 leathery valves, the true septum small, with a much larger false septum in its middle parallel to the valves; seeds oblong, winged at the ends.—Only the following species is cult. in S. Calif. and it is, even without fls., a handsome foliage plant. Cult. like *Radermachia*, to which it is closely related.

platýcalyx, Sprague. Tree, to 40 ft.: lvs. $\frac{1}{2}$ –1 ft. long, with suborbicular pseudostipules $\frac{1}{2}$ –1 in. broad in the axils; fls. 5–9, short-stalked, elliptic-oblong to obovate, abruptly and obtusely acuminate, entire or serrate, lepidote, 2–5½ in. long; panicles terminal or axillary, rather dense; calyx boat-shaped, pubescent and lepidote, $\frac{3}{4}$ in. long; corolla yellow, inside striped red, lepidote, inside and outside, veined, the tube $1\frac{1}{4}$ –1½ in. long, the elliptic-obovate lobes about $\frac{1}{2}$ in. long; caps. linear, 1 ft. long. Uganda. H.I. 23:2800.—Said to yield the finest timber in Uganda.

ALFRED REHDER.

MARROW, VEGETABLE: *Squash*.

MARRÛBIUM (ancient name, referring to the bitter qualities). *Labiata*. **HOARHOUND**. **HOREHOUND**. A familiar aromatic herb.

Marrubium comprises perennials branched from the base, mostly silky or woolly, with wrinkled and crenate or cut lvs., and many-fld. axillary whorls of small white or purplish fls.; calyx tubular, 5–10-nerved and with 5 or 10 awl-shaped teeth; corolla 2-lipped, the upper lip erect and notched or entire, the lower spreading and 3-cleft; stamens 4, didynamous, not exerted; ovary deeply 4-lobed (making 4 smooth nutlets), the style 2-lobed.—Species 30–40, in Eu., N. Afr. and extra-trop. Asia; one widely naturalized in the U. S.

vulgare, Linn. **COMMON HOREHOUND**. Height 1–3 ft.: sts. ascending, woolly or tomentose; lvs. ovate to round-ovate, stalked; calyx with 10 recurved teeth, the alternate ones shorter; fls. whitish. Summer.—Now found as an escape from gardens in waste places of nearly every country of the world. Horehound is used in large quantities for confections and medicines for coughs and colds.

candidissimum, Linn. Foliage silvery gray, flannel-like, the branches long; perennial; lvs. ovate, crenate; fls. whitish, in large many-fld. fascicles; calyx-teeth subulate, rigid, spreading, usually 5, but sometimes 6–10. Spain to Caspian Mts.

L. H. B.

MARSDÊNIA (William Marsden, 1754–1836, wrote a history of Sumatra). *Asclepiadaceæ*. Mostly twining shrubs of warm countries, a few of them sometimes planted for ornament; some of them medicinal and yielding dye and fiber.

The genus is allied to *Stephanotis*, which has large white fls., while those of *Marsdenia* are smaller and usually purplish, lurid, greenish or pallid. Lvs. opposite; cymes umbel-shaped, simple or branched, terminal or axillary; calyx 5-parted; corolla bell-, urn- or salver-shaped; lobes narrow or broad, overlapping to the right; crown of 5 scales; seeds comose, in a more or less fleshy follicle.—In tropical and subtropical countries around the world, the species probably being nearly 100. Genus rather heterogeneous.

Rôylei, Wight. Lvs. 3–6 in. long, 2–4 in. wide, ovate-cordate, acuminate, pubescent or tomentose beneath; petioles $1\frac{1}{2}$ –2 in. long; cymes 1–1½ in. across; fls. 3–4 lines in diam.; corolla somewhat bell-shaped; lobes large, fleshy, pubescent; stigma not extended beyond the anthers. Hinnalayas, 4,000–5,000 ft. altitude.

macrophylla, Fourn. Woody twiner: lvs. large, oval, acuminate, the base truncate or subcordate, glabrous, somewhat glaucous beneath; calyx deeply cut, the segms. large, oval, obtuse; corolla-tube glabrous, the limb spreading, and the lobes oval and short-ciliate on margin. Brazil; Paraguay (?).—Offered in S. Calif.

verrucôsa, Deene. Twining, the branches thick: lvs. broadly or nearly orbicular-cordate, abruptly acuminate, glabrous, glandular at top of petiole; fls. many, in a short cluster; corolla-lobes ovate, somewhat emarginate, barbed; lobes of corona lanceolate and fleshy. Madagascar.—Offered abroad.

M. Cundurango, Reichb. f. (*Gonolobus Cundurango*, Triana), of Ecuador and Colombia, yields the medicinal cundurango bark: liana: lvs. round-oblong, acute, hairy beneath; fls. whitish, the corolla somewhat campanulate.—*M. erecta*, R. Br., is fairly hardy at Arnold Arboretum: fls. white, fragrant; lvs. cordate-ovate. S. E. Eu., Syria.—*M. Induraria*, Hemsl. A vigorous twining shrub with long hanging branches and fls. resembling a Hoya: lvs. ample, long-petioled, rather thick and soft and bullate (blistered), cordate-ovate; fls. about $\frac{1}{2}$ in. across, purple, hairy, in dense globular very short-stalked axillary umbellate cymes. British Guiana. B.M. 7953.

L. H. B.

MARSHÁLLIA (Humphrey Marshall, wrote "Arbustum Americanum," 1785, the first American work on trees and shrubs; also founded one of the first American botanic gardens). *Compósitæ*. Perennial North American herbs, useful in outdoor planting.

Tufted plants, growing about 1 ft. high, with entire lvs. and seapes bearing solitary rayless heads about $1\frac{1}{2}$ in. across; involucre hemispheric or bell-shaped, its bracts narrow and green; fls. all perfect and fertile; pappus of 5–6 acute or acuminate scales.—About a half-dozen species. All may be grown in the open border in the N. and they may be prop. by division in the spring. Supposed to suggest the seabious. The blue anthers give a peculiar effect to the fls.

cæspitôsa, Nutt. Tufted, glabrous: lvs. spatulate-linear; upper ones linear: bracts of the involucre linear: disk-fls. pale rose or white; seeds inversely pyramidal, villous on the angles. Limestone soil, Mo., to Texas. B.M. 3704.

grandiflora, Beadle & Boynton. Like the next except that the st.-lvs. are oblong-lanceolate and acute or obtuse. Moist soil, Pa. to W. Va. and N. C.

trinervia, Walt. St. simple or branched, usually leafy about half way up; lvs. acuminate at the apex, narrowed to a practically stalkless base; fls. purplish sometimes whitish, pink; bracts of the involucre linear-lanceolate. Va., south.

N. TAYLOR.†

MARSH MALLOW: *Althæa officinalis*.

MARSÍLEA (Giovanni Marsigli, Italian botanist of last part of the 18th century, or Aloys Ferd., Graf von Marsigli, 1658–1730). *Marsilicææ*. Aquatic flowerless plants related to ferns (about 40 species), with

lvs. like 4-lyd. clover or oxalis, one species of which, *M. quadrifolia*, Linn., is sold and is also run wild in the eastern states. It is a creeping plant, rooting in the mud on the margins of ponds and making an attractive cover. The petioles grow 3-5 in. tall, or taller in the water, and bear at the apex 4 bright green obovate or triangular lfts. The sporocarps or frs. are nearly sessile at the base of the petioles. Prop. easily by pieces of the runners, and is likely to become a weed. The young lfts. close at night. Eu. and Asia. Mn. 6, p. 107. *M. Drummondii*, A. Br. (Fig. 2327), is a greenhouse species needing moderate temperatures and pot cult. with abundance of surplus water in saucers or even set in a tank, partly submerged. Under the best conditions the long clover-like lvs. may reach a length of 18 in., and form a very attractive plant. The stalks and lfts. are covered with whitish hairs; the spores are borne in cases on separate stalks an inch or so long.

R. C. BENEDICT.

MARTINÈZIA (Rev. Dr. Baltasar Jacobo Martinez Companon, archbishop of Santa Fé, who sent many early collections of plants from Peru). *Palmaceæ*, tribe *Bactridææ*. Ornamental feather-leaved palms, with spiny ringed trunks.

Leaves pinnate, the segms. broad, wedge-shaped, alternate or grouped, the apex truncate and ragged; petioles and rachis spiny, as are also the spadices and spathes of the infl.; fls. rather small, the calyx with 3 segms.; stamens 6, inserted in the disk; fr. globose, 1-celled, orange, scarlet or rose-pink.—Species about 8. Trop. Amer. G.C. II. 26:491.

Martinezias are beautiful palms, and make fairly good house plants but their spiny character is against their popularity. They must have a stove temperature. They do not require a great amount of soil. Light sandy loam, with plenty of sharp sand, is best. They need abundant moisture.

They sometimes flower in cultivation, but the four kinds given below are distinct by their foliage and spines. Like all armed palms, they are slow to germinate, but after the first or second year they grow fairly fast. The commonest and best kind is *M. caryotæfolia*, which has fewer spines than the other species and, unlike many other palms, shows its true leaves at a very early stage. It resembles the fish-tail palms (*Caryota*), but the leaves are a lighter green and usually larger. *M. crosa* makes a better specimen at 5 to 6 feet than when small. It is much more jagged at the tips of the leaves. Being very spiny all over, it is less desirable. *M. Lindeniana* is more like the first. The spines are longer but not very numerous. *M. granatensis* is of coarser habit and slower growth, and desirable only

for large collections. (H. A. Siebrecht.)

A. Lvs. divided into segms.

B. Segms. in groups.

C. Apex of segms. 3-lobed.

caryotæfolia, HBK. Sts. at length 30-50 ft. high but usually not over 6 in. thick; lvs. few, 3-6 ft. long, light green; lfts. in groups, 6-12 in. long, 4-6 in. wide at the apex; st., petioles, rachis and nerves below, densely

clothed with long black spines; spadix about 18 in. long, appearing between the lvs.; fr. yellowish red, about $\frac{3}{4}$ in. long. Colombia. G.C. 1872:181. B.M. 6854. F.R. 2:49.

cc. Apex of segms. with a point projecting from the upper margin.

Lindeniana, Wendl. Sts. 9-15 ft. high; pinnae in opposite groups of 4-6, the groups widely separated, long-wedge-shaped, 10-14 in. long, 8-10 times as long as broad, with a short, projecting point at the upper margin, the nerves ciliate-spiny toward the end; petiole densely covered with grayish brown hairs, with many rather large black spines 1-2½ in. long; rachis is also spiny above and below; midnerve of each segm. a trifle shorter than the lower margin and spiny beneath, like the rachis and lateral nerves; lvs. dark green above, lighter beneath; terminal segm. broadest; fr. rose-red. Mts. of Colombia, at an altitude of 6,000 ft.

BB. Segms. in 2-4 pairs.

erôsa, Lind. Lvs. with 2-3 pairs of narrow lfts. at base and a pair of broader ones at the apex, all oblique at the apex, bearing long, brown, needle-shaped spines on the veins and midrib; rachis cylindrical or obtusely angled, mealy, clothed with spines like those on the lvs. W. Indies. G.C. 1872:1297.

AA. Lvs. bifid at the apex.

granatensis, Hort. (*M. granatensis*, Hort.). Lvs. roundish oblong or roundish ovate, entire at the base, bifid at the apex, evenly toothed along the edges; petioles and rachis with dark brown, needle-shaped, spreading or reflexed spines, $\frac{1}{2}$ -1 in. long. Colombia.

M. truncata, Brongn. Trunk about 20 ft.; lvs. 4-5 ft. long, spreading, the petiole and trunk covered with brownish black spines; lfts. smooth, prominently veined and beautifully dark green.—A fine showy Bolivian species scarcely known in the trade.

JARED G. SMITH.

N. TAYLOR.†

MARTIUSELLA (after K. F. Ph. von Martius, German botanist, 1794-1868; traveled in Brazil 1817-20, wrote *Historia Naturalis Palmarum* and started the monumental work, *Flora Brasiliensis*, continued after his death by A. W. Eichler and I. Urban). *Sapotæææ*. An evergreen small tree from Brazil with large alternate serrate lvs.; fls. small in axillary clusters; calyx 5-, rarely 4-parted; corolla rotate, 5-6 lobed; stamens 5, inserted at the base of the corolla opposite to the lobes and nearly as long as the corolla; sometimes with staminodes between the petals; ovary 5-celled with short style; fr. subglobose, 3-5-seeded; seeds compressed; cotyledons thin. Closely allied to *Chrysophyllum* which is chiefly distinguished by its smaller entire lvs., the longer corolla-tube, shorter stamens and the thick cotyledons, and also by the much-branched habit. The only species is *M. imperialis*, Pierre (*Theophrasta imperialis*, Lind. *Chrysophyllum imperiale*, Benth. & Hook.). See also p. 767, Vol. II. Strict and simple, to 20 ft. high or more; lvs. obovate-oblong to oblong-oblancoleate, rounded at the apex, serrate with strong parallel veins, stellate-pilose beneath at first, becoming glabrous, 8 in. to 3 ft. long; fls. yellowish green, $\frac{1}{4}$ in. across, pedicelled, in axillary sessile clusters; fr. subglobose, 1½ in. long, with a hard thick flesh; seeds chestnut-brown, lustrous, about 1 in. long and $\frac{3}{4}$ in. wide. Brazil. B.M. 6823. J.H. 21:184. Gt. 13:453.—It can be grown outdoors only in frostless regions; sometimes cult. in greenhouses for its large handsome foliage. It flowers very rarely in cult., flowering first in 1885 after it had been in cult. for 40 years. Prop. is by seeds or by cuttings in March when the new growth is starting; the upper part of the plant is cut into as many pieces as there are lvs., the cuts being made just below the base of the lvs.; the cuttings are inserted in sand under glass with bottom heat; they usually take a long time to form roots.

ALFRED REHDER.



2327. *Marsilea Drummondii*.

MARTYNIA (John Martyn, 1699–1768, professor of botany at Cambridge, botanical author). Including *Proboscidea*. *Martyniaceae*. Coarse annuals and perennials from the warmer parts of America, a few of which are cultivated for pickles or for ornament.

Rank branchy plants of heavy odor, viscid-pubescent, mostly sprawling on the ground; lvs. large, likely to be opposite and alternate on same plant, petioled, broad and subcordate, entire or lobed; fls. large and funnellform-campanulate in short loose terminal racemes; calyx more or less swollen-campanulate, deeply and unequally 5-parted, often split on the anterior side; corolla violet-purple, pale yellow or whitish mottled, oblique, decurved, the limb somewhat bilabiate but the 5 spreading lobes nearly equal; fertile stamens 2 in the genus *Martynia* as defined by Stapf (Engler & Prantl, *Die Pflanzenfamilien*, including one species apparently not in cult.), and 4 in the genus or group *Proboscidea* which is here included in *Martynia* and to which the cult. species belong; ovary 1-celled, the 2 parietal placentae extended inward and meeting at the middle as if 2-celled; fr. a 2-valved caps., more or less fleshy, hairy, with a long curving beak; seeds large.—Species about S. U. S. to S. Amer. The closely allied *Cranioalaria* (which see, in Vol. II) is distinguished by the long slender corollatube (*Martynia Cranioalaria*, Glox.=*Cranioalaria annua*). The trade names need revision.

Martynias are sometimes grown in gardens for their bright large flowers, abundant foliage and odd pods. They are treated as half-hardy annuals. They are also grown in the vegetable-garden for the small tender pods which are made into pickles the same as cucumbers. The plants grow 1½ feet or more high, and spread widely. They should be started in a hotbed in the North and transplanted to the open. In the middle and southern states seed may be sown in the open 3 feet apart each way where the plants are to remain. They need a warm open soil and sunny exposure. The fruits have a very distinct appearance by reason of the long-curved horn which splits from the top as the capsule hardens.

A. Lvs. more or less lobed; fls. purple or reddish.

fragrans, Lindl. (*M. formosa*, Vilm. *M. violacea*, Engelm.). Annual: less stout than *M. louisiana*: lvs. roundish to oblong-cordate, somewhat lobed and wavy-toothed, 3–5 in. broad; corolla campanulate, 1 or 2 in. long and wide, fragrant, reddish purple to violet-purple. Texas, New Mex., Ariz., N. Mex. B.M. 4292. B.R. 27:6. R.H. 1843:529.

AA. Lvs. sinuate or perhaps dentate, not lobed; fls. mostly whitish or yellowish but sometimes purplish.

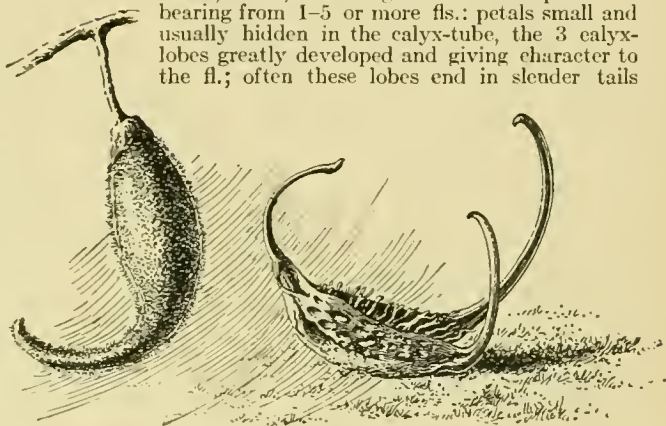
louisiana, Mill. (*M. proboscidea*, Glox. *Proboscidea Jussieu*, Steud.). UNICORN PLANT. PROBOSCIS FLOWER. Fig. 2328. Annual, the ascending or prostrate branches 2–3 ft. long; lvs. roundish, cordate, often oblique, entire or obscurely wavy-lobed, 4–12 in. wide; fls. 1½–2 in. long, dull white or yellowish with mottles or spots of purple or yellow within, the corolla nearly as broad as long, the lobes obtuse; fr. 4–6 in. long at maturity, the beak equaling or exceeding the body. Native from Ind. to Utah and to Texas and New Mex.; naturalized farther east and north. B.M. 1056. V. 3:151.—The picture (Fig. 2328) shows frs. one-third the size at full maturity. The right-hand specimen shows the woody part, after all the soft parts have been macerated.

lutea, Lindl. (*M. montevidensis*, Cham.). Annual, 1½ ft., the plant pale, glandular-pubescent; lvs. cordate-orbulate, subdentate, 5–7-nerved; fls. few, in erect terminal racemes, large, greenish yellow outside and orange inside; corolla funnel-shaped, the tube constricted; caps. woody, boat-shaped, cristate on back,

2-beaked at apex, the beaks 2 in. long. Brazil. B.R. 934. Perhaps not in the trade. L. H. B.†

MASDEVALLIA (Joseph Masdevall, a Spanish physician and botanist). *Orchidaceae*. Orchids, not showy, but odd and often grotesque.

Pseudobulbs none: lvs. variable in size, oblong to linear, thick, sheathing at the base; peduncles bearing from 1–5 or more fls.; petals small and usually hidden in the calyx-tube, the 3 calyxlobes greatly developed and giving character to the fl.; often these lobes end in slender tails



2328. *Martynia louisiana*. (×½)

pseud inches long; lip of the corolla short, articulate with the base of the winged or wingless column, in some species sensitive; pollinia 2, without cauleles.—More than 150 species, inhabitants of the American tropics, and various hybrid and garden forms. The species of the *M. coccinea* group are relatively simple in form, but are usually prized for their brilliant coloring. Those of the *M. Chimera* group are remarkable for their fantastic shapes. Of late years many new kinds have been intro., and the genus is somewhat confused as to the specific limits of the various forms. *Masdevallias* are polymorphous, and herbarium specimens do not show specific characters well. See "The Genus *Masdevallia*," by Florence H. Woodward (1896).

Cultural directions. (R. M. Grey.)

Masdevallias are found growing at high elevations, ranging from 6,000 to 12,000 feet above sea-level, in northwestern South America and Central America, with a few sparingly distributed elsewhere over tropical America. These regions are generally subjected to two rainy seasons annually, often with very short intermissions. The atmosphere, though somewhat rarified, is very humid, the temperature in the shade seldom rising above 65° F., and often dropping to 40° in some districts. Heavy fogs are frequent, especially in the forepart of the day, and during the greater part of the year the under-vegetation is in a saturated condition; the high winds prevalent in these districts, however, counteract to a great extent any evil influence which might otherwise arise from it.

The heat of our summer makes it quite impossible to imitate wholly the above conditions, but with a proper house, such as is afforded odontoglossums of the crispum section, very satisfactory results may be obtained and the many species will be found of comparatively easy culture. A low, well-ventilated, half-span house of northern exposure, with an upright stone or brick wall on the south side, is best adapted to them. The house should be provided with canvas roll-shading, supported on a framework elevated 15 or 18 inches above the glass in order that the cool air may pass freely beneath it. This will help to guard against solar heat during summer. Houses built partly below ground are not to be recommended, as the atmosphere soon becomes stagnant and inactive, causing the leaves to fall pre-

maturely. When it is convenient, solid beds are preferable; benches, however, will answer the purpose very well, and when used should be covered about 2 inches deep with sifted ashes, sand or gravel; the benches and floors should be hosed down once or twice daily to afford all the cool moisture possible.

In winter the temperature should range between 50° and 55° F. at night and about 60° during the day or 5° more on mild days, with weak solar heat and ventilation. Artificial heat must be dispensed with as early in spring as possible, and during summer the temperature kept as low as the weather will permit, ventilating freely, especially at night, when a light syringing overhead will also prove beneficial. Midday syringing in hot weather is often injurious and should be done with caution if at all. More benefit will result from hosing down the shelves and paths at intervals of three or four hours, as it will help to reduce the temperature.

Masdevallias need a great deal of water at the roots at all seasons, and the soil should never be allowed to dry out, as they have no fleshy pseudobulbs to protect them against extreme changes. Light syringing overhead during winter and spring in fine weather will assist in checking thrip and red-spider, and a weak solution of tobacco may be added with good effect.

The best season for repotting and basketing the plants is during November

and December, and the best general compost is a mixture of clean peat fiber and sphagnum moss chopped rather fine and well mixed, some sections requiring in addition a portion of chopped sod. About one-third of the space should be devoted to clean drainage consisting of either broken charcoal or potsherds.

M. coriacea, *M. elephanticeps*, *M. Peristeria*, *M. Reichenbachiana*, and kindred species, grow best in small pots, and should have one-third chopped sod added to their potting compost. *M. macrura*, *M. Schlimii*, *M. tovarensis*, *M. amabilis*, *M. coccinea*, *M. Veitchiana*, *M. triangularis*, *M. polysticta*, *M. muscosa*, and the numerous other allied species, grow equally well in either pots or baskets, but should the latter be used it would be well to add a small portion of chopped sod to the compost to make it more firm and less porous; the sod has a cooling effect on the roots. *M. bella*, *M. Carderi*, *M. Chestertonii*, *M. Chimara*, *M. Houtteana* and their allies nearly all have pendulous flower-scapes, and should be suspended from the roof in baskets in a compost of equal parts chopped peat-fiber and live



2329. *Masdevallia coccinea*. (×½)

sphagnum, with a little leaf-mold added. The flower-scapes often penetrate through the compost; for this reason little or no drainage should be used, as it may retard their progress.

To increase the stock the plants must be divided during the early winter; this will give them a chance to reestablish themselves before the following summer. They must not be broken up into too small pieces, as it has a tendency to weaken them.

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SECTION I.

A. Calyx-lobes glandular with minute papillæ.....	1. Veitchiana
AA. Calyx-lobes not glandular.	
b. Tail of the dorsal lobe hanging forward.....	2. militaris
	3. rosea
BB. Tail of the dorsal lobe erect and straight.....	4. amabilis
	5. Davisii
	6. Barlaana
BBB. Tail of the dorsal lobe reflexed and flexuous.....	7. coccinea

1. *Veitchiana*, Reichb. f. Tufted; lvs. 4-6 in. long, narrow; peduncle erect and slender, 1 ft. or more, with 2 or more bracts (the upper one remote from the fl.); calyx with bell-shaped tube, the expanding lobes 3 in. across, orange-red, with purple shades, glandular-hairy, abruptly contracted into short, narrow tails; petals white, hidden. Peru. B.M. 5739. C.O. 4a. Var. *grandiflora*, Hort., has a dense hairy covering on the dorsal lobe of calyx; and also on the outer part of the lateral lobes, the inner part orange-scarlet. C.O. 4b.

2. *militaris*, Reichb. f. & Warscz. (*M. ignea*, Reichb. f.). Much like the last, but differs in having elliptic or elliptic-obovate lvs., which are long-petioled, and in the lateral calyx-lobes being only prominently pointed, not tailed, the dorsal lobe very narrow and hanging forward between the other two: color orange and

scarlet; petals white, exceeding the column. Spring. Colombia. B.M. 5962. I.H. 26:333. G.M. 52:283. C.O. 2. Var. *Massagœna*, Hort. Lateral lobes longer; fls. larger. Var. *Bôddærtii*, Hort. Calyx yellow; lower lobes shaded with red on the upper surface. I.H. 26:357. Var. *grandiflora*, Hort. Fls. rounded; lateral sepals brilliant vermilion, bordered with crimson and suffused with purple. Var. *superba*, Hort., is advertised.

3. *rôsea*, Lindl. Lvs. oblong-spoon-shaped, keeled; peduncle drooping and slender, bearing a single fl.; calyx-tube 1 in. long, red and violet; calyx-lobes rose-lilac, with red tails; petals yellow, the lip hairy at the apex. Ecuador. G.C. III. 16:657. O.R. 4:113; 11:25. July, Aug.—A pretty and free-flowering species.

4. *amabilis*, Reichb. f. & Warsez. Lvs. 4-5 in. long, oblong- or spatulate-lanceolate, about half the length of the erect, usually 1-ld. peduncles: fls. varying from purplish crimson to yellow; lobes ovate-triangular, the lateral ones with short tails and the dorsal ones with a long and ascending tail; petals narrow, yellowish, longer than the column. Peru. Sept.-Dec. Var. *lineata*, Lind. & André (var. *striata*, Hort.), has yellowish fls., tinged and striped with red. I.H. 22:196.

5. *Davisii*, Reichb. f. Densely cespitose: lvs. oblong-lanceolate, 6-8 in. long, petioled, blunt at the apex; peduncle erect, about 10 in. long; calyx large, brilliant yellow, obscurely veined with deeper yellow; dorsal lobe triangular-ovate, prolonged in a tail; lateral lobes oblong-ovate, larger, united to below the middle, terminating in short tails; petals longer than the column, nearly hidden in the calyx-tube, pale yellow, the labellum yellow, shaded and spotted with red, with 2 obscure keels. Peru. B.M. 6190. C.O. 1.

6. *Barlœana*, Reichb. f. Lvs. spatulate, acute; peduncle slender, nearly 1 ft. long; fls. scarlet; calyx-tube curved; dorsal sepals short-triangular, produced into a long tail; lateral sepals larger, semi-ovate; petals ligulate, white. Peru.—Reichenbach states that the lateral sepals run internally one in another; they are connate in a straight line.

7. *coccinea*, Lind. (*M. Lindenii*, André). Fig. 2329. Lvs. spatulate, obtuse or retuse, 6-10 in. long; peduncle 1 ft. or more long; calyx crimson-magenta; dorsal lobe with a small, triangular base, prolonged into a long tail; lateral lobes oblong-ovate, scarcely prolonged; petals white, longer than the column. May. Colombia. B.M. 5990. I.H. 17:42. F.M. 1872:28. Var. *conchiflora*, Veitch. Fls. large; lateral lobes of labellum rotund, concave. Var. *Harryana* (*M. Harryana*, Reichb. f.). Lateral lobes of calyx oval, falcate, the tips usually crossing or turned toward each other. May. F.S. 21:2250. C.O. 7. Var. *armeniaca*, Hort. Fls. apricot-yellow, veined with red; throat of the tube yellow. Colombia. Var. *atrosanguinea*, Hort. Fls. large, with the lateral sepals crimson spotted with magenta, points falcate, turned toward each other. Colombia. Var. *cœrulescens*, Hort. Lateral sepals broadly semi-ovate, apiculate, crimson-magenta spotted with bluish purple. Colombia. Var. *Gravesia*, Hort. Fls. white. Var. *grandiflora*. Fls. large, rose-purple. Colombia. Var. *Dénisonii*, Hort. BULL'S BLOOD. Fls. crimson-purple.

SECTION II.

- A. *Habit of scape drooping or deflexed.*
 B. *Scape about as long as the lvs.* 8. *platyglossa*
 BB. *Scape shorter than the lvs.* 9. *leontoglossa*
 AA. *Habit of scapes erect or suberect.*
 B. *Scape shorter than the lvs.*
 C. *Lvs. linear to linear-oblong* 10. *coriacea*
 11. *civilis*
 12. *Peristeria*
 CC. *Lvs. oblong to lance-oblong.*
 D. *Fls. white or whitish, often spotted or lined* 13. *ionocharis*
 14. *nidifica*

- DD. *Fls. yellow or red* 15. *corniculata*
 16. *macrura*
 DDD. *Fls. crimson* 17. *calura*
 BB. *Scape longer than the lvs.*
 C. *Size of fls. rather small, with a broad, basin-like tube: plants dwarf.* [worthii]
 D. *Fls. mauve* 18. *Shuttle-*
 DD. *Fls. yellow, marked or spotted* 19. *xanthina*
 20. *triangularis*
 21. *Wageneriana*
 DDD. *Fls. varicolored* 22. *Estradæ*
 23. *hieroglyphica*
 CC. *Size of fls. larger, with a broad, deep, gibbous tube* 24. *elephanticeps*

8. *platyglossa*, Reichb. f. Densely tufted: lvs. spatulate-lanceolate, narrowed into petioles, 3-4 in. long, as long as or longer than the drooping bracted 1-2-fl. peduncles: fl. small (1 in. long), pale yellow, nearly globular, the lobes pointed but not tailed, the dorsal one upcurved; ovary red; petals linear, as long as the column. Colombia (?) B.M. 7185.

9. *leontoglossa*, Reichb. f. Tufted: lvs. oblanceolate, short-petioled, spotted beneath with red; peduncle deflexed, mostly shorter than the odd fls.; calyx narrow, the lobes gradually narrowed into fleshy tails or long points, semi-transparent, all of them greenish yellow outside and more or less hairy crimson-spotted within, the dorsal lobe not greatly unlike the others but often somewhat ascending; petals white with crimson lines. Colombia. B.M. 7245. C.O. 12.—The specific name ("lion-tongued") refers to the bearded lip.

10. *coriacea*, Lindl. Lvs. linear-lanceolate, usually somewhat surpassing the erect, 1-fl., spotted peduncles, which are about 6 in. high: fls. fleshy, the calyx-lobes nearly equal and wide-spreading, triangular at base but gradually narrowed into long points or short tails; lobes greenish yellow and dotted crimson inside; petals white and crimson. Colombia. G.C. III. 21:95.—Lvs. 6-8 in. long, with purplish dotted petioles.

11. *civilis*, Reichb. f. (*M. rufo-lilica*, Lindl.). Lvs. fleshy, linear, keeled, 5-6 in. long; peduncle less than 2 in. long, erect or nearly so; fls. solitary, rather large for the size of the plant, the deep calyx-tube purple at the base and yellow at the top, the long-pointed, flattened lobes yellow; petals small, white, the labellum dotted purple. Peru. B.M. 5476.

12. *Peristeria*, Reichb. f. Tufted: lvs. oblanceolate, sometimes retuse at the apex, 4-6 in. long, twice longer than the rather stout, erect, 1-fl. peduncles: fls. with 3 long, wide-spreading tails, which span 4-5 in., the tube somewhat gibbous beneath; back of the fl. greenish yellow; tails honey-yellow; throat and base of lobes spotted with crimson; petals linear-oblong, white. Colombia. B.M. 6159. F.S. 22:2346. C.O. 11.—Named from its resemblance to the dove orchid, *Peristeria*.

13. *ionocharis*, Reichb. f. Lvs. ovate-lanceolate, exceeding the erect peduncle: fl. whitish, purple-spotted at base, the lobes triangular-ovate, with yellow tails; petals cream-white. Peru.

14. *nidifica*, Reichb. f. Lvs. oval or oblong, about the length of or longer than the peduncle: fl. white, veined and dotted with crimson passing into yellow on the lobes, the lobes hairy and with long, slender tails, which are yellow in the lateral lobes and crimson in the dorsal lobe; petals white, with crimson lines. Ecuador.

15. *corniculata*, Reichb. f. Sts. short and tufted: lvs. spatulate, very short-pointed, mostly exceeding the 1-fl. peduncles: fls. with yellow, inflated calyx-tube, which is spotted with brown and ribbed, bearing long, very slender brown tails; petals yellow. Colombia. Var. *inflata*, Veitch. Paler in color, and with smaller spots; lobes broader and golden yellow. Colombia. B.M. 7476.

16. *macrura*, Reichb. f. Sts. short and tufted, each bearing a solitary fl. and fl.: lvs. broadly spatulate or broad-oblanccolate, very obtuse or even retuse; peduncles 8-10 in. high, erect; fls. with 3 long tails, which span 8 in. from top to bottom; calyx-tube red-purple on the outside; lobes triangular-ovate in the basal portion, dull red and purple-spotted within, the cylindrical tails yellow, the lateral ones 7-ribbed; petals yellow, spotted brown. Colombia. B.M. 7161. C.O. 8.

17. *calura*, Reichb. f. Lvs. mostly shorter than the peduncles, oblong-lanceolate; fls. glossy crimson, with slender, flat tails; dorsal lobe somewhat triangular at base, the lateral ones round-ovate; petals crimson, with white on tip and margins. Aug. Costa Rica.—A free-flowering species.

18. *Shuttleworthii*, Reichb. f. A small species, with lvs. only 2 in. long, on distinct petioles of equal length; peduncles several, 1-fld., sometimes overtopping the lvs.; fls. large (1 in. across and the tails 2-3 times as long), mauve, dotted with crimson; tails all yellow in the upper half, very slender, the upper one sometimes bent or hooked at the top; petals white. Colombia. B.M. 6372. I.II. 28:435. C.O. 6. Var. *xanthocorys*, Reichb. f., has smaller fls. of pale yellow, dotted with brown or rose.

19. *xanthina*, Reichb. f. Like the last, except that the fl. is yellow, with a purplish spot on the lateral lobes. Var. *pallida*, Hort., has fls. almost white. Colombia.

20. *triangularis*, Lindl. Lvs. oblanceolate; peduncle erect, about 4 in. tall; fls. yellow, marked or spotted with purple, the tails dark crimson; lobes similar, triangular-ovate; petals white, the lip spotted with pink or purple and hairy. Venezuela.

21. *Wageneriana*, Lind. Very small, neat and attractive, tufted, 2-3 in. high: lvs. spoon-shaped; peduncles equaling or exceeding the lvs., nearly erect; fls. yellow and crimson-dotted, with slender yellow tails, the upper one inclined backward; lobes broad, cordate or ovate; petals yellow, odd in shape, the lip rhomboid and toothed. Venezuela. B.M. 4921.

22. *Estradae*, Reichb. f. Very densely tufted: lvs. and petioles 3 in. long, the blade broad, spoon-shaped, and often retuse at the apex; peduncle usually somewhat exceeding the lvs., erect, 1-fld.; fl. of marked colors—the upper concave lobe yellow at base and violet-purple above, the lateral lobes violet-purple at base and white or straw-colored above; tails filiform, yellow; petals white, very small. Colombia. B.M. 6171.

23. *hieroglyphica*, Reichb. f. Lvs. oval or oblong; peduncle short (about 3 in. long); fl. with tube yellowish at bottom, becoming whitish, marked with crimson; lobes triangular-ovate, all with long tails, the tail of the dorsal lobe hanging forward and marked with purple at its base; petals yellow. June. Colombia.

24. *elephanticipes*, Reichb. f. An odd species: lvs. broad-spatulate, obtuse; peduncles 1 ft. long, erect; fl. single, parti-colored—the dorsal or upper lobe light yellow, the lateral ones ribbed and crimson; calyx-tube gibbous at the base below, all of them gradually produced into stout yellow tails (one of them often crimson), arranged so as to suggest the tusks and raised trunk of an elephant (whence the specific name). Colombia. F.S. 10:997. B.M. 7824. C.O. 10. Var. *pachysépala*, Reichb. f. (*M. Mooreana*, Reichb. f.), has the dorsal lobe 3-nerved with crimson; tube spotted.

SECTION III.

- A. Lvs. covered with round papillae;
scape hairy.....25. *muscosa*
AA. Lvs. smooth.
B. Fls. small, in many-fld. racemes;
angles of the ovary crenulate or the
petals toothed.
c. Color of fls. pale lilac.....26. *polysticta*
cc. Color of fls. white.....27. *abbreviata*
28. *melanopus*
29. *caloptera*
ccc. Color of fls. yellow.....30. *pachyura*
BB. Fls. larger, often expanding in suc-
cession: raceme several-fld.; angles
of the ovary and petals entire.
c. Color of fls. white.....31. *tovarensis*
cc. Color of fls. yellow, dotted and
shaded with brown or red.
D. Lateral sepals united, forming
a boat-shaped cup.....32. *Ephippium*
DD. Lateral sepals nearly plane, at
least not strongly cucullate.
E. Tails of the lateral sepals very
short or none.....33. *racemosa*
EE. Tails of the lateral sepals long.
F. Lvs. broad, obovate-elliptic.....34. *Schlimii*
FF. Lvs. oblong-lanceolate or
oblanceolate.
G. Calyx-tube funnel-
shaped, narrowed at
the base.....35. *Reichen-*
bachiana
GG. Calyx-tube broader or
gibbous at the base.....36. *maculata*
37. *infracta*

25. *muscosa*, Reichb. f. Fig. 2330. Lvs. oval-oblong, papillose; peduncle hairy, 3 times exceeding the lvs., with 1 yellow fl.; lobes triangular, with reflexed tails; petals narrow and yellow with a brown line in the center, the lip bearing a raised yellow disk and moving upward with a jerk when this disk is touched. Ecuador, Colombia. O. 1913:105.—Fls. $\frac{1}{2}$ in. across. See Leavitt, Plant World, April, 1906, from which Fig. 2330 is adapted.

26. *polysticta*, Reichb. f. Densely tufted: lvs. narrow-spatulate, obtuse and often retuse; peduncle exceeding the lvs., about 8 or 9 in. tall and many-fld.; fls. pale lilac, spotted with purple, the margins of the



2330. *Masdevallia muscosa*.

sepals ciliate but not serrate, the tails very slender and spreading (fl. 2-2½ in. across) and yellowish; petals spatulate and serrate. Peru. B.M. 6368. I.H. 22:199. R.H. 1880:250.

27. *abbreviata*, Reichb. f. Lvs. oblong-lanceolate; peduncle many-fld., about 6 in. long; fl. white and freely dotted with red, the tails all deep yellow, the lobes serrate on the edges; petals white, longer than the column, serrate. Peru.

28. *melanòpus*, Reichb. f. Much like *M. polysticta*: fls. smaller, white speckled with purple, the dorsal sepal keeled, the lobes not ciliate or serrate on the edges and very suddenly contracted into slender yellowish or dark-colored tails; petals linear-oblong, toothed below the apex. Peru. B.M. 6258 (as *M. polysticta*).

29. *calóptera*, Reichb. f. Lvs. oblong-ovate; peduncle short (5 or 6 in.), many-fld.; fl. white with crimson streaks, the tails all slender and orange; dorsal lobe keeled and somewhat hooded; the lateral ones ovate-oblong; petals white, crimson-keeled, serrate. Peru.

30. *pachyura*, Reichb. f. Lvs. oval-oblong; peduncle erect, slender; calyx with triangular, short-tailed lobes, yellow, with transverse bars and spots of reddish crimson; dorsal sepal triangular, with a thick tail equaling the sepal in length; petals pale yellow. Ecuador. G.C. III. 22:255; 49:89. B.M. 8361.

31. *tovarénsis*, Reichb. f. Fig. 2331. Lvs. rather small, linear-spatulate; peduncle 5 or 6 in. long, sometimes exceeding the lvs., 2-edged, several-fld.; fls. clear white and fragrant, the tails yellowish at the ends; dorsal lobe 1½ in. long, very narrow and produced into a reflexed tail; lateral lobes oval, gradually produced into tails shorter than that of the dorsal lobe; petals white. Dec., Jan. Colombia. B.M. 5505. I.H. 26:363. Gn. 48, p. 384. G.C. 1865:914; 1871:1421. J.H. III. 57:99. C.O. 13. O.R. 13:58.—One of the best of the genus.

32. *Ephippium*, Reichb. f. (*M. trochilus*, Lind. & André). Lvs. broad, oblong, 5-7 in. long; peduncle erect, about a foot long, sharply 3-4-angled, stout; calyx with the dorsal lobe cucullate, yellow, dotted with brown, ½ in. diam.; lateral lobes united, forming a deep boat-shaped, chestnut-brown cup, with several ridges which are greenish outside; all the lobes pass into yellowish tails about 4 in. long; petals white. Colombia. B.M. 6208. I.H. 21:180. C.O. 9.—According to Index Kewensis, *M. trochilus* and *M. Ephippium* are distinct species. The former is described as having terete sts.

33. *racemosa*, Lindl. (*M. Cróssii*, Hort.). Sts. creeping; lvs. oblong-ovate, much shorter than the several-fld. racemose peduncles; fls. membranaceous, orange with red lines, erect, 1 in. across, tails very short or none; lateral lobes ovate, blunt-pointed, curving outward so as to form a 2-lobed limb, the dorsal lobe ½ in. long and pointed. Peru. C.O. 3.—Not a popular species. Requires a coolhouse.



2331. *Masdevallia tovarensis*.
(×½)

34. *Schlimii*, Lind. Tufted; lvs. elliptic-obovate, petioled, a foot or less long, half shorter than the several-flowered peduncles; fls. dull yellow, mottled with bright brown, the tails yellow, about 1¼ in. across without the tails; tails 2-3 times longer than the body of the calyx-lobes, very slender; petals pale yellow, linear-oblong, equaling the column. Venezuela. B.M. 6740. G.C. II. 19:532.

35. *Reichenbachiana*, Endres. Densely cespitose; lvs. oblanceolate, shorter than the several-fld. peduncles; fl. dark red on the outside, yellowish, with red veins on the inside, all the lobes with turned-back tails, the lobes triangular. Costa Rica.

36. *maculata*, Klotzsch & Karst. Lvs. narrow-oblan- ceolate, nearly or quite equaling the erect several-fld. peduncle (which is 8-10 in. tall); fls. yellow-tubed, suffused or dotted with red, all the lobes produced into orange-yellow or greenish tails 2 in. long; lateral lobes crimson, with yellow on the margin, the tails drooping; petals yellowish. Venezuela. F.S. 21:2150.

37. *infracta*, Lindl. Cespitose; lvs. oblong-lanceolate to narrow-lanceolate; peduncle about 6 in. long, several-fld.; calyx pink-purple; dorsal sepals cucullate, lateral sepals entirely united, forming a wide, gaping tube, with cucullate sides and apex, passing into slender, yellowish tails; petals whitish, dotted with pink-purple. Brazil. F.S. 23:2389.

SECTION IV.

- A. Fls. campanulate.....38. *Carderi*
- AA. Fls. not campanulate.
- B. The fls. with cream-white ground, crimson-spotted.....39. *Houtteana*
- BB. The fls. with yellow ground.
- C. Free part of sepals orbicular, abruptly tailed.....40. *radiosa*
- CC. Free part of sepals ovate, narrowed into the tail.
- D. Inner surface of sepals glabrous.....41. *bella*
- DD. Inner surface of sepals with white hairs.....42. *nycterina*
- DDD. Inner surface of sepals with warts and hairs.....43. *Chimæra*
- BBB. The fls. with green or yellowish green ground.....44. *Chestertonii*

38. *Cárderi*, Reichb. f. Cespitose, with strong ascending foliage and hanging spotted 1-fld. peduncles; lvs. oblanceolate, 3-5 in. long; peduncles green-bracted, 3 in. long; fls. bell-shape, ¾ in. across exclusive of the tails, white, with purple and yellow bars at the base; tails very slender and spreading, 1 in. long, yellow; petals small, white, linear-oblong and obtuse. Colombia. B.M. 7125.—A graceful and pretty species.

39. *Houtteana*, Reichb. f. (*M. psittacina*, Reichb. f.). Densely cespitose; lvs. linear to lance-linear, much exceeding the drooping or deflexed 1-fld. peduncles (which are 4-5 in. long); fls. creamy white, spotted with crimson, the long hanging tails brownish red; calyx-lobes semi-ovate to triangular, somewhat hairy (as are also the tips of the tails); petals white or pinkish. Colombia. F.S. 20:2106.

40. *radiosa*, Reichb. f. Lvs. oblong or lanceolate; peduncle 2-3-fld., drooping or deflexed; fls. yellow, dotted and splashed with purple, the prominent tails all purple; petals yellow, purple-spotted, but the lip whitish. Colombia.

41. *bella*, Reichb. f. Lvs. oblong-lanceolate, channelled, about 8 or 9 in. long, narrowing to the base; peduncle 1-fld., drooping or horizontal, ½ ft. long, slender; fls. large and spider-like, triangular in outline, 3 in. across, with stiff tails 4 in. long, of which the dorsal is recurved and the others standing forward and usually crossed, the fl. pale yellow, spotted with purplish or brown; petals white or yellowish. Colombia. Oct.-Dec. G.W. 4, p. 77. C.O. 14.—One of the best of the chimarras.

42. *nycterina*, Reichb. f. Often confused with *M. chimara*, but a smaller and less showy plant; tufted; lvs. oblanceolate, somewhat fleshy, channelled, 6 in. long, not narrowed into a petiole; peduncle 1-fl'd., 3 in. long, drooping; fl. triangular, 2 x 3 in., with tails 3 in. long, hairy inside, brown-yellow and purple-spotted; petals yellow, with red spots, pouch-like, serrate. Colombia. L.H. 20:117, 118 (as *M. Chimara*).—Odd.

43. *Chimara*, Reichb. f. Fig. 2332. Tufted; lvs. oblanceolate-obtuse, 1 ft. long and $1\frac{1}{2}$ in. wide; peduncle wiry, erect, lateral or pendent, several-fl'd., mostly shorter than the lvs.; fls. opening in succession; calyx-lobes ovate, yellowish, much spotted with deep crimson-purple, tapering into slender tails from 3-11 in. long, purple-brown; petals white, marked with crimson; labellum saccate, white, yellow or pinkish, very variable. Colombia. R.H. 1881:130. G.C. II. 3:41. C.O. 5.—One of the most fantastic of orchids, and the type of a most interesting group.

Var. *Roëzlii*, Hort. (*M. Roëzlii*, Reichb. f.). No long hairs on the calyx-lobes, the lobes very dark-colored, with short warts; labellum pink, not yellow. Color the darkest of the section. Often regarded as a good species. Sub-var. *rùbra*. Spots on calyx-lobe brown-crimson.

Var. *Wállisii*, Hort. (*M. Wállisii*, Reichb. f.) Calyx-lobes with hispid pubescence, yellowish, spotted with brown-purple; labellum white, yellow within.

Var. *Winniàna*, Hort. (*M. Winniàna*, Reichb. f.) Calyx-lobes elongated, densely black-spotted. In part distinguished from var. *Roëzlii* by its longer tails.

Var. *Backhousiàna*, Hort. (*M. Backhousiàna*, Reichb. f.) Lvs. narrower than in the type; fls. large; calyx-lobes more round, paler, not so thickly spotted; tails short; labellum nearly white.—Perhaps a distinct species.

44. *Chéstertonii*, Reichb. f. Tufted; lvs. oblong or oblong-spatulate, 5 in. long and nearly or quite 1 in. wide, somewhat longer than the pendent, much-bracted, 1-fl'd. peduncles; fls. $2\frac{1}{2}$ in. across, greenish yellow, spotted and streaked with purple, and bearing 3 spreading, greenish, more or less hooked, flattened tails 1 in. long; petals yellow, very small. Colombia. B.M. 6977.—Odd and distinct.

SECTION V.

45. *triaristèlla*, Reichb. f. Lvs. about 2 in. long, in very crowded tufts; peduncles longer than the lvs., very slender, erect, wiry; dorsal lobe of calyx ovate, hooded; tail yellow; lateral lobes coloring throughout their length, linear, united, at length diverging into short

yellow tails; petals yellow, with a red midline. Summer. Costa Rica.—One of the smallest of orchids.

The following have been offered in Amer., but most of them are imperfectly known. *M. cheiróphora*.—*M. Chélsónii*=*M. anabalis* × *M. Veitchiana*.—*M. gibberosa*=*Scaphospalum*.—*M. Hendersoni*.—*M. punctata*=*Scaphospalum*.—*M. trifida*.

M. Alceste=*M. Veitchiana* × *M. Asnodia*.—*M. Arminii*, Reichb. f. Fls. with whitish tube, the free portion of sepals crimson-purple, the lateral with filiform yellowish tails 1-2 in. long. Colombia. J.H. III. 50:313; 61:577. —*M. burfordiensis*, O'Brien. Fls. white, profusely dotted with claret-color; petals white, with purple lobes; lip purple. —*M. deorsum*, Rolfe. Fls. yellow, blotched bright red; dorsal sepal reflexed, contracted suddenly into a tail 2-3 in. long; lateral sepals gradually narrowed into shorter tails. Colombia. B.M. 7766. G.C. II. 28:395. —*M. Ortigiesiana*, Hort. Scape 1-fl'd.; fls. pale greenish white. —*M. peruviana*, Rolfe. Petals white, tinged with lilac; sepals light brown. Peru. —*M. Pourbaizii*, Hort.=*M. Veitchiana* × *M. Shuttleworthii*. Fls. vermilion, flushed with orange-yellow, and marked with numerous brownish red dots. G.M. 47:373. Lind. 9:387. —*M. Schroederiana*, Hort. Sepals abruptly contracted into yellow tails, the dorsal arched, the lateral much recurved, thickly 3-nerved, bullate, white marked with red. Peru (?). B.M. 7859. —*M. Tondúzii*, Woolward. Peduncle slender, 1-fl'd.; sepals connate at base, whitish citron-colored inside, elongated into slender yellow tails. Costa Rica. —*M. venosa*, Rolfe. Perianth straw-yellow, densely spotted with dull purple; lip dull red-purple. Colombia. —*M. Xiphères*, Reichb. f. Allied to *M. muscosa*; fls. small, purple, on tall slender sts. Colombia.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

MASSÁNGEA (named for a Belgian horticulturist, M. Massange de Louvrex). *Bromeliaceae*. A disputed genus; by Bentham & Hooker included in *Caraguata*, and by Mez combined with *Guzmania*. The single species admitted by Wittmack in Engler & Prantl, *M. musáica*, Morr., becomes *Guzmania musáica* (*Tillandsia musáica*, Lind. & André. *T. mosáica*, Hort. *Vrièsia musáica*, Hort.), by the Mezian disposition (see Vol. III, p. 1419). It is a good warmhouse subject.

MASSÓNIA (Francis Masson, 1741-1805, collector in S. Afr.). *Liliaceae*. South African bulbous plants, of more than 30 species, allied to *Allium*; rarely grown as pot-plants in the greenhouse. Plants with 2 or 3 very broad opposite lvs., and a very short scape so that the usually white or greenish fls. are borne in a sessile or nearly sessile globose head at the surface of the ground surrounded by several membranaceous bracts; perianth with a cylindrical tube and narrow spreading or reflexed nearly equal segms.; stamens 6, inserted at the throat, the filaments more or less united at the base; ovary 3-celled and many-ovuled, becoming a membranaceous 3-valved caps. *M. pustulata*, Jacq., has an ovoid bulb, 1 in. diam., ribbed tuberculate broad-oblong lvs., and greenish fls. in the cup of pustulate foliage; perianth-tube cylindrical, the segms. narrow and spreading; stamens long and upstanding. B.M. 642. G.C. III. 39:44.—An odd plant, requiring warm greenhouse conditions.

L. H. B.

MATRICARIA (*mater*, mother, from its use in diseases). *Compositae*. MATRICARY. WILD CHAMOMILE. Annual or perennial weedy herbs, often heavily scented.

From *Chrysanthemum* it differs mostly in the achenes, which are 3-5-ribbed on the interior face and ribless on the back; also in having a higher or more conical receptacle, and bracts in few rather than many series.—About 25 species in many parts of the world. The foliage is much cut or divided into thread-like divisions. The matricarias are border plants in cult., and others are intro. weeds. They are commonly confounded with species of *Chrysanthemum* and feverfew. The *M. crima plena* of the trade is a form of *Chrysanthemum Parthenium* (var. *tubulosum*). It is a good hardy annual, with white double heads, growing 2 ft. tall. Matricarias demand the care given to annual chrysanthemums. The three following are annuals or biennials.

inodóra, Linn. (*Chrysanthemum inodórum*, Linn. *Pyrrhtrum inodórum*, Smith). Nearly or quite glabrous, branchy, diffuse annual, 1-2 ft. tall, from Eu.

and Asia: lvs. many, sessile, 2-3-pinnately divided or dissected: heads $1\frac{1}{2}$ in. across, terminating the branches, with many acute white rays: achenes inversely pyramidal, with 3+ conspicuous ribs. Not uncommon in fields eastward. Var. *plenissima*, Hort. (var. *ligulosa*, var. *multiplex*, *M. grandiflora*, Hort. not Fenzl), is a



2333. *Matricaria Chamomilla*. ($\times 14$)

common garden plant with very double clear white large heads. It is floriferous, and the fls. are fine for cutting. G.C. H. 12:753.—It often persists and blooms the second year. Foliage little or not at all scented.

parthenoides, Desf. (*M. capensis*, Hort., not Linn. *Anthemis parthenoides*, Bernh. *Chrysanthemum parthenoides*, Voss). Annual, or biennial under cult., 2 ft. or less high, soft-hairy when young, but becoming smooth, bushy in growth: lvs. petiolate, twice divided, the ultimate segms. ovate and often 3-lobed: fl.-heads loosely corymbose, in the garden forms usually double, white.—A handsome plant, probably of Old World origin, useful for pots, and blooming till frost.

Chamomilla, Linn. (*Chamomilla officinalis*, Koch). WILD CHAMOMILE. Fig. 2333. Glabrous erect much-branched annual: lvs. 2-3-pinnate, with segms. short and very narrow-linear, giving the lf. a finely dissected appearance: heads rather large (nearly 1 in. across), on terminal peduncles, with 10-20 truncate white rays; bracts of involucre of about equal length, the edges scariosus; receptacle without scales, elongating and hollow as anthesis advances: achene with 3-5 faint ribs and no border at top. Fields, Eu. and N. Asia; run wild in E. U. S.—Very similar in appearance to *Anthemis Cotula* (Fig. 219), but lacks the scales between the central florets and has a different odor. The name chamomile, or sometimes spelled camomile, is applied both in *Matricaria* and *Anthemis*.

L. H. B.

MATRIMONY VINE: *Lycium*.

MATTEÛCCIA (from C. Mattenecci, an Italian physicist). *Polypodiaceae*. A small group of north temperate ferns with lvs. of two sorts, the sterile growing in crowns from erect rootstocks, and the fertile growing from the interior of the crown. Our species is known as the ostrich fern and is one of the most easily cult., as well as one of the handsomest of our native species. It multiplies rapidly by offsets sent out from the root-stock. Known also as an *Onoclea* or *Struthiopteris*.

For cult., see p. 1217. For further botanical relations, see *Onoclea*.

Struthiopteris, Todaro (*Struthiopteris germanica*, Willd. *Onoclea Struthiopteris*, Hoffm.). OSTRICH FERN. Lvs. (sterile) 2-6 ft. long, with the lowest pinnae gradually reduced: fertile lvs. 1-2 ft. long, pinnate, with the margins of the pinnae closely inrolled and covering the sori. Eu. and N. E. N. Amer.—Willdenow regarded the American species as distinct, but by most botanists it is considered identical with the European species.

L. M. UNDERWOOD.

MATTHIOLA (Peter Andrew Matthioli, 1500-1577, Italian physician and writer on plants). Sometimes (and originally) spelled *Mathiola*. *Cruciferae*. STOCK. GILLIFLOWER, when used at the present day, means *Matthiola* or sometimes *Cheiranthus*; formerly it designated *Dianthus Caryophyllus*. Familiar flower-garden and florists' subjects.

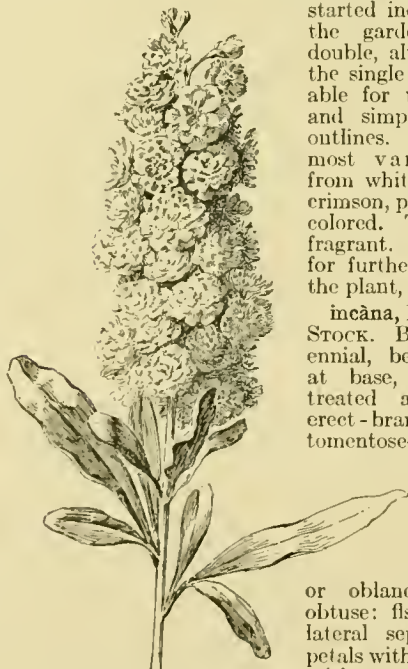
From *Cheiranthus*, the wallflower, this genus differs in its winged seeds, which are as broad as the partition, the stigma-lobes erect or connivent and often thickened on the outside, the silique not 4-sided (terete or compressed). Of *Matthiolas* there are probably 50 species, widely distributed in the Old World and Austral., 2 in S. Afr. They are herbs or subshrubs, tomentose, with oblong or linear-entire or sinuate lvs., and large, mostly purple fls. in terminal racemes or spikes.

The true stocks (Fig. 2334) are of this genus. The Virginian stocks are diffuse small-flowered annuals of the genus *Malcomia* (which see). Stocks are of two general types,—the autumn-blooming, Queen or Brompton stocks, and the summer-blooming, ten-weeks or intermediate stocks. By some persons these classes are made to represent two species, *M. incana* and *M. annua* respectively. It is probable, however, that they are garden forms of one polymorphous type. Even if distinct originally, it is not possible now to distinguish them by definite botanical characters.—Stocks are amongst the most common of all garden flowers. The two types cover the entire

blooming season, particularly if the earlier ones are started indoors. Most of the garden forms are double, although some of the single types are desirable for the definiteness and simplicity of their outlines. The colors are most various, running from white through rose, crimson, purple and parti-colored. The flowers are fragrant. For culture and for further discussion of the plant, see *Stock*.

incana, R. Br. COMMON STOCK. Biennial or perennial, becoming woody at base, but usually treated as an annual: erect-branching, closely tomentose-pubescent, the sts. stiff and cylindrical: lvs. alternate, tapering into a petiole, long-oblong

or oblanceolate, entire, obtuse: fls. with saccate lateral sepals and large petals with long claws and wide-spreading limb, borne on elongating stalks in an open, terminal erect



2334. Ten-weeks stock—*Matthiola incana* var. *annua*. ($\times 15$)

raceme; siliques becoming 3-4 in. long, erect. *Medit.* region; also Isle of Wight.—*M. glabrata*, DC., is a glabrous form.

Var. *annua*, Voss (*M. annua*, Sweet. *M. græca*, Sweet). TEN-WEEKS, or INTERMEDIATE STOCKS. Fig. 2334. Annual, less woody, blooming earlier.—A shining-lyd. variety is known. Var. *autumnalis*, Voss. Autumn-blooming or Brompton stocks.

bicôrnis, DC. Half-shrubby, straggling annual or biennial; fls. smaller than those of *M. incana*, purplish or lilac, fragrant by night, closing by day; pod terete, long, 2-horned; lvs. pinnatifid, or the uppermost entire. Greece, Asia Minor. Gn. M. 3:226.

M. coronopifolia, DC. Perennial, somewhat woody at base, hoary-pubescent; lvs. linear-oblong, sinuate-lobed or somewhat pinnatifid; petals wavy, vinous purple. Sicily. B.M. 7750.—*M. maderensis*, Lowe. Woody at base, spreading; lvs. long-lanceolate, acute, soft-tomentose, usually entire; fls. pale violet, or violet-purple, rarely white, fragrant. Madeira. Gt. I. 354.—*M. pedemontana*, Hort. Apparently a form of *M. varia*; fls. light rosy purple; decorative for the rock-garden. G. C. III. 53:149.—*M. sinuata* var. *oxyensis*, Roux. & Fouc. (*M. oxyensis*, Ménéier), is figured in B. M. 7703, where it is said that "the name *oxyensis* has been corrupted in gardens to *chiensis* and *chinensis*." The plant is from the Ile d'Yeu (Insula Oya, whence the name) on the coast of France. It is an annual or biennial, with sinuate-toothed lvs., hairy, and with large white fragrant fls. Not known to be in cult. in this country.—*M. varia*, DC. Italy and Greece, a variable species, some forms of which may appear in cult. Perennial; lvs. linear, obtuse, entire, canescent; petals oval, undulate, purplish.

L. H. B.

MAURANDIA (after Maurandy, professor of botany at Cartagena, Spain). Also written *Maurandya*. *Scrophulariaceæ*. Perennial herbs, grown for the showy flowers and for the climbing habit of some of them.

Botanically, this genus is near to the snapdragon, though the throat of the fl. is not closed. The plant

white, rose, purple and blue, the throat usually white or light-colored, somewhat 2-lipped.

Perhaps the commonest cultivated species is *M. Barclaiana*, which is procurable in a greater range of colors than the others. Maurandias are desirable vines for winter-flowering in cool greenhouses, but since they bloom the first year from seed, they are almost wholly grown for summer bloom outdoors and treated like tender annuals. They have a slender habit and grow about 10 feet in a season. In autumn the vines may be taken up and removed into the house if desired. In some of the recently introduced species the habit is prostrate or pendulous rather than climbing.

Maurandias can be increased either by seed or cuttings. When grown from seed, the pans or flats should be given a liberal amount of crocks, and this covered with some coarse material. For a compost use four parts new loam, two parts leaf-mold, one part sand, well mixed together. Fill the pans to about $\frac{1}{2}$ inch from the top, firming the material. For covering the seeds, screen some of the compost and cover about three times the size of the seed. Water with a fine rose. Place the pans in a house with a night temperature of 60°. Cover with glass and keep shaded until they start to germinate. When large enough to handle, pot off into 2- or 2½-inch pots, using the same compost, adding about one-fourth part of well-decayed cow-manure. When intended for the conservatory, they should be shifted along until they are in 6- or 7-inch pots. For these larger shifts use a compost of four parts of fibrous soil, one part each of cow-manure and leaf-mold, and a small amount of bone-meal. Maurandias can also be grown from cuttings taken any time after the middle of January, using an intermediate propagating-bed and grown on as above stated. For their general culture, they like a night temperature of 55° to 60° with a rise of 10° to 15° with sun heat. Water should be given when they show a dryness at the roots. On bright days they should receive a good syringing to keep the foliage clean and healthy. When they have filled the soil with roots, liquid manure given about once a week will keep them vigorous. Train the shoots and give them additional room as they may require. Maurandias are largely grown for baskets, vases and the like. The most troublesome insects are red-spider and aphids. Syringe to keep the former in check and fumigate frequently for aphids. (J. J. M. Farrell.)

A. Plant climbing.

B. Seeds tubercled, wingless: calyx-segms. narrow: lvs. hastate, not serrate. (Subgenus *Eumaurandia*.)

C. Calyx distinctly glandular-pilose; segms. long-attenuate.

Barclaiana, Lindl. Usually, but not originally, written *Barclayana*. Climber, somewhat woody; lvs. angular, cordate, acuminate, the petioles longer than the blades and twining; fls. about 3 in. long, downy outside, deep purple, perianate; upper lip of corolla with 2 transverse rounded lobes, the lower lip with 3 roundish ovate lobes. Mex. B.R. 1108. L.B.C. 14:1381. V. 5:353.—The following trade names advertised like species-names are presumably all color-varieties of this species: *M. alba*, *M. albiflora*, *M. Emeryana*, *M. rosea*, *M. Lucciana*, *M. purpurea grandiflora*, *M. varius*. The last is a trade name for mixed varieties.

cc. Calyx glabrous, shorter.

scândens, Pers. (*Ustèria scândens*, Cav. *M. semperflorens*, Ort.). Shrubby below; lvs. halberd-shaped, long-acuminate, the margins not toothed; fls. lavender-colored; throat white. Mex. B.M. 460.—Cult. in S. Calif.

BB. Seeds with a lacerated or irregular wing; calyx-segms. leafy and broad: lvs. triangular-ovate, serrate.

c. Corolla-lobes obtuse or even notched.

erubescens, Gray (*Lophospermum erubescens*, Don). Woody climber, glandular-hairy: lvs. somewhat trian-



known to the trade chiefly as *Maurandia antirrhiniflora* is now referred to *Antirrhinum*. (See *Antirrhinum*, Vol. I, p. 305, where this plant is described and figured.) It is a climber and requires the cult. of maurandias. Maurandias climb by the twisting of the lf.- and fl.-stalks. They are glabrous or pubescent; lvs. alternate, or the lower ones opposite, triangular or halberd-shaped, angular-lobed or coarsely toothed; calyx 5-parted; segms. narrow or broad; corolla-tube scarcely bulged or gibbous at the base, essentially funnelliform, with bearded lines instead of a palate; posterior lip 2-cut; anterior lip variously parted; stamens 4, didynamous; fr. a caps. with winged or wingless seeds.—About 6 or 5 species of Mexican and Arizonian plants, mostly climbers, with showy, irregular trumpet-shaped fls.,

gular in outline, serrate; petiole as well as peduncle twining: fls. 3 in. long, rosy pink. Mex. B.M. 3037, 3038 (as *L. scandens*). B.R. 1381, G.C. II. 20:501.—Cult. in S. Calif.

cc. *Corolla-lobes more acute*.

Lophospérmum, Bailey, nom. nov. (*M. scandens*, Gray, not Pers. *Lophospérmum scandens*, D. Don). Fig. 2335. Perhaps a botanical variety of the preceding. Branches long and slender, glandular-pubescent: lvs. opposite below and alternate above, cordate, subacute, unequally toothed, the petiole twining: corolla twice as long as calyx, rose-purple, obscurely dotted outside, the tube white; lobes triangular ovate, acute or the lower ones nearly obtuse. B.M. 3650.—A handsome plant. A hybrid with the preceding is shown in B. 5: 242. The plants passing in gardens as *M. scandens* need to be worked over botanically.

AA. *Plant not climbing, although with pendulous or loping growth.*

Púrpusii, Brandege. Ascending, pendulous or prostrate, 12-16 in., leafy, with tuberous rootstock: lvs. long-stalked, more or less triangular-ovate: fls. axillary, long-peduncled, purple-carmine, beautiful. S. W. Mex.—A showy tender perennial, blooming the first year from seed, of bushy growth; tubers may be stored in winter. Differs from *M. crubescens* in being more glabrous and bearing smaller fls.; lvs. often entire-margined.

M. Conzatti, Hort., that has been listed in S. Calif. = *M. scandens*, Pers.

L. H. B.†

MAURÍTIA (after Prince Moritz, of Nassau, 1567-1665, patron of Piso and Maregraf; by his aid a Natural History of Brazil was published). *Palmaeae*, tribe *Coriophinae*. Very graceful fan palms, very little grown in America except in botanic gardens.

Stems very slender, obscurely ringed, almost spineless: lvs. pinnately flabelliform, semi-circular, orbicular or wedge-shaped, the lobes lanceolate, acuminate; rachis long or short; petiole cylindrical: ovary perfectly 3-celled.—There are 6 or 7 species, all Trop. American. Mauritia must be grown in rich soil in a very hot moist house with a day temperature of 80-85°. The pots of small plants are often partly submerged in water. G.C. II. 26:491.

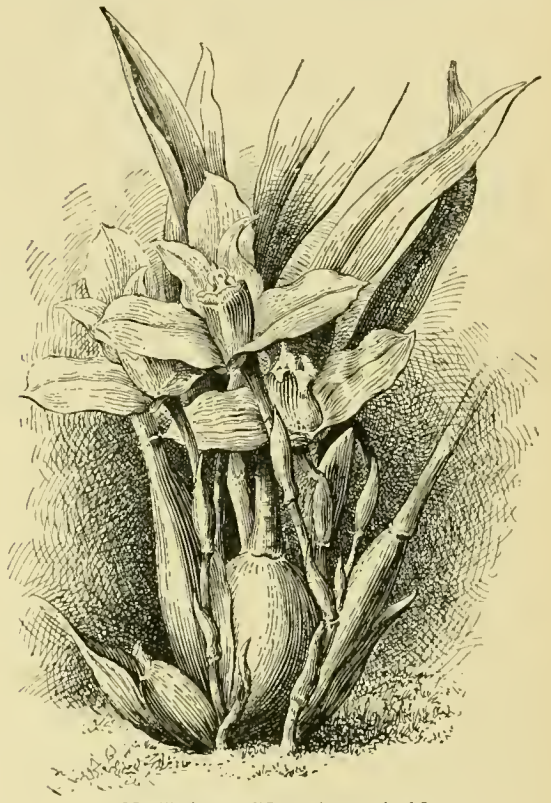
flexuosa, Linn. f. **MORICHE PALM**. **ITA PALM**. Sts. without stolons, in nature often 90 ft. tall: lvs. 20-30, erect-spreading, 9-16 ft. long; blade 2½-4 ft. long, yellowish beneath; lobes ¾-1½ in. wide; petiole stout, rigid, semi-cylindrical, equalling the blade: fr. nearly 2 in. long, depressed-globose; seed 1½ in. long. Trop. Brazil.—Offered in 1889 by Reasoner Bros. In the Amazon delta this palm grows to 150 ft. or more in height, with a trunk often 30 in. diam. at base. "The fr. is spherical, the size of a small apple, and covered with rather small, smooth, brown, reticulated scales, beneath which is a thin coating of pulp. A spadix loaded with fr. is of immense weight, often more than two men could carry between them."—Wallace, "Palms of the Amazon." It forms extensive forests, and provides material for subsistence and arts of the Indians.

N. TAYLOR.†

MAUROCÈNIA (J. F. Mauroceni, Venetian senator and horticulturist). *Celastraceae*. One shrub in S. Afr., producing a drupe as large as a cherry and called "Hottentot cherry," *M. frangulária*, Mill. (*M. capensis*, Sond. *Cassine Maurocènia*, Linn.). Glabrous, 4-6 ft., with 4-angled twigs: lvs. coriaceous, opposite, entire, suborbicular to elliptical or obovate: fls. small, greenish to white, in axillary clusters; calyx very small, 5-parted; petals 5, exceeding the calyx; disk ring-like; stamens 5, exceeding the petals: drupe somewhat juicy, with a hard stone. Cape of Good Hope region.—Apparently not in the trade.

MAXILLÀRIA (Latin, *maxilla*, jaw; referring to the mentum). *Orchidaceae*. Mostly pseudobulbous epiphytic orchids, resembling lycaste in general appearance.

Rhizomes short or long, creeping or erect, and clothed with distichous lvs.: pseudobulbs clustered or scattered on the rhizome, 1-2-lvl. or densely distichophyllous at



2336. *Maxillaria grandiflora*. (× nearly ½)

the apex of the rhizome: lvs. leathery or subfleshy, plicate or plane and keeled, distichous: sepals subequal, free from each other but united with the foot of the column and forming a projecting mentum; petals similar or smaller; labellum 3-lobed, movably articulated to the foot of the column; lateral lobes erect; middle lobe with longitudinal callosities; the scape arises apparently from the base of the pseudobulb, on the very young leafy axis, but lower down than the corresponding new growth; pollinia 4, seated on a broad, scale-like stipe.—Over 100 species, dispersed at various altitudes in Mex., Brazil and the W. Indies. About 15 species are offered by dealers in Amer. Many of these have small fls. and are of value only in collections. They are, however, easily grown, and blossom profusely. Among those given below, the large white-fl. *M. grandiflora* and *M. venusta*, and the white and purple *M. Sanderiana* are probably the best species. The distichous arrangement of the lvs. distinguishes this genus from *Lycaste*. For *M. Harrisonii* and *M. tetragona*, see *Lycaste*.

Maxillarias are of easy culture, and can be grown under various methods of treatment with fair success. The best compost consists of clean peat fiber taken from the several species of *Osmunda*, and live sphagnum, both chopped rather fine and well mixed together. After the receptacle is half filled with clean drainage and the plant properly placed, the compost should be pressed firmly in around the roots, interspersing it with nodules of charcoal. In their native habitats, many of the

fine-rooted species grow on rocks and trees with very little compost attached. The base of the pseudobulbs or rhizome should rest on a convex surface raised a little above the rim of the pot when finished. Maxillarias delight in a cool, moist, shaded location at all seasons; the winter temperature should not exceed



2337. *Maxillaria Sanderiana*. (×1½)

55° F. by night and not over 60° or 65° by day. During summer they must be grown as cool as possible with ventilation at all seasons when admissible, especially in wet heavy weather. Water should be given in abundance while the plants are growing and not too sparingly when at rest, as the plants are subject to spot if kept too dry. Weak liquid cow-manure is beneficial occasionally during root-action.—Maxillaria has two recognized horticultural groups or sections; viz., caulescent and stemless. The caulescent section embraces *M. tenuifolia*, *M. variabilis* and kindred species, having scandent rhizomes and often obscure flowers. These should all be grown under pot culture and afforded supports to climb on, such as small cylinders or rafts of open woodwork with a little compost worked in the openings, or osmunda rhizomes supported obliquely in the pots to which the plants can attach themselves as they grow upward, and thus be supplied with moisture for the young roots. To the stemless section belong those with clustered pseudobulbs, as *M. grandiflora*, *M. luteo-alba*, *M. picta*, *M. Sanderiana* and *M. venusta*. Some of the these have very showy flowers. Nearly all do best under pot culture. *M. Sanderiana* and others are exceptions, however, and grow best under basket culture, not too much compost and an airy position. Demand for maxillarias not being great, the market usually relies on new importations, but stock may also be increased by division between the pseudobulbs as the plants start new action. (Robt. M. Grey.)

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KEY TO THE SPECIES.

- A. *Pseudobulbs clustered on the creeping rhizome.*
 - a. *Fls. mostly white, large and showy.*
 - c. *Sepals long-lanceolate.* 1. *venusta*
 - cc. *Sepals broad, ovate, triangular or oblong.*
 - d. *Middle lobe of the labellum tongue-like.* 2. *grandiflora*
 - dd. *Middle lobe of the labellum rounded.* 3. *Lehmannii*
 - BB. *Fls. yellow and brown.*
 - c. *Sepals and petals nearly alike, oblong.* 4. *Sanderiana*
 - cc. *Sepals and petals dissimilar, the latter smaller.* 5. *Lindeniae*
 - 6. *picta*
 - 7. *rufescens*
 - 8. *elegantula*
 - 9. *luteo-alba*
 - 10. *striata*
- AA. *Pseudobulbs more or less distant, on an ascending rhizome; lvs. grass-like; fls. small and numerous.* 11. *Houtteana*
- 12. *variabilis*
- 13. *tenuifolia*

1. *venusta*, Lind. & Reichb. f. Pseudobulbs oblong, compressed, 2-4 in. long; lvs. oblong-lanceolate, acuminate, plane, 1 ft. long; scapes 6 in. long, bearing a single glistening white fl. 6 in. across; sepals and petals long-lanceolate, acuminate, spreading; the lateral sepals wider, labellum much smaller; middle lobe triangular recurved, obtuse, yellow; lateral lobes very obtuse, bordered with red; disk with a rounded, hairy callus. Winter and spring. Colombia. B.M. 5296. G.C. III. 12:367 (abnormal).—A large-fl., showy species.

2. *grandiflora*, Lindl. Fig. 2336. Pseudobulbs clustered, oval; lvs. erect, plane, keeled, ovate-oblong, 1 ft. long; scapes erect, 3-6 in. long, bearing solitary, large white fls. 3-4 in. across; sepals broadly ovate to oblong; petals ovate-acute, suberect, with recurved tips; labellum saccate, white, much-striped with purple on the sides; middle lobe tongue-like, white, bordered with yellow. Aug. Peru and Colombia. I.H. 17:14.—A very showy and beautiful plant.

3. *Lehmannii*, Reichb. f. Fl.-stalks nearly 1 ft. long, bearing white fls. nearly as large as those of *Lycaste Skinneri*; side lobes of the labellum light ochre outside and light reddish brown with chestnut veins inside; middle lobe triangular, wavy, sulfur-color. Ecuador.—Resembles *M. grandiflora*, but distinguished by the character of the lip.

4. *Sanderiana*, Reichb. f. Fig. 2337. Pseudobulbs orbicular to broadly oblong, 1-1½ in. long; lvs. few, 6-10 in. long, oblanceolate, plane, keeled; scapes 2-3 in. long; fls. 4 in. across, pure white, with the bases of the segms. purplish red, broken upward into blotches; dorsal sepals oblong-obtuse, concave; lateral sepals triangular-ovate, forming a broad numentum at base; lateral lobes of the labellum almost obsolete, middle lobe rounded, crisp, bright yellow, throat dark purple, with a club-shaped callus. Ecuador. B.M. 7518. R.H. 1894:526. J.H. III. 26:495. G.M. 52:414. O. 1909; 26. A.G. 9:13 (adapted in Fig. 2337).—The finest known species.

5. *Lindeniae*, Hort. (*M. Lindeniana*, Rich. & Gal.). Plants resembling *M. Sanderiana*, but the fls. larger and more open; sepals triangular-lanceolate, spreading, 3 in. long, pure white; petals shorter and wider, erect, white; labellum fleshy, obovate, somewhat crisp, recurved, pale yellow, with 5-6 red lines on the lateral lobes. S.H. I:219.

6. *picta*, Hook. (*M. fuscata*, Klotzsch). Pseudobulbs 1½ in. high, ovate, furrowed, bearing 1-2 plane, strap-shaped lvs. 1 ft. long; scape 5-6 in. high; fls. nodding; sepals and petals oblong-linear, acute, incurved, deep

orange spotted with purple within, white with deep purple spots outside; labellum oblong, whitish, spotted; side lobes small, rounded; midlobe recurved, apiculate. Winter. Brazil, Colombia. B.M. 3154. B.R. 1802.—Handsome.

7. *rufescens*, Lindl. (*M. fuscata*, Reichb. f.). Pseudobulbs ovate, subtetragonal, 1-lyd.: lvs. lanceolate, acuminate; scape short, with 1 small fl.; sepals and petals oblong-obtuse, yellow-tinged and spotted with reddish orange; side lobes of labellum small, sharp; middle lobe elongate, sub-quadrate, emarginate; all yellow, spotted with crimson. Trinidad. B.R. 1818.—Not valuable.

8. *elegantula*, Rolfe. The bases of the segms. white, the outer halves pale yellow, marked with chocolate-color. Nov. G.C. III. 22:420.—From the illustration, the sepals are ovate-lanceolate, wavy and recurved, the lower pair broader; petals smaller, pointing forward, concave, wavy, with reflexed tips: lvs. lanceolate-acute.

9. *luteo-alba*, Lindl. Pseudobulbs long-ovate, 1-lyd., $2\frac{1}{2}$ in. high: lvs. broad, obtuse, narrowed at the base, 1 ft. long; scapes 6 in. long; sepals 3 in. long, $\frac{1}{2}$ in. wide, tawny yellow fading to white at the base, brown on the back, the lower pair drooping; petals erect, pointing forward, one-half as long, white to brown and yellow above; side lobes of the labellum yellow with purple streaks; middle lobe recurved, hairy, yellow, with white margins. Colombia. G.C. III. 43:165.—A robust species, which soon fills large-sized pans, making very ornamental plants.

10. *striata*, Rolfe. Scapes 6-8 in. long, bearing solitary fls. 4-5 in. across the sepals; dorsal sepals ovate-oblong; lateral sepals ovate-attenuate, forming a broad mentum at the base, often twisted and recurved; petals narrower, wavy; both sepals and petals are yellow, striped with red-brown; lobes of the labellum crenate-wavy, white with purple veins, the lateral ones recurved. Aug. Peru. G.C. III. 20:631. G.M. 41:705.

11. *Houtteana*, Reichb. f. Fig. 2338. Rhizome erect or ascending, clothed with brown sheaths: pseudobulbs 2- $2\frac{1}{2}$ in. long, linear-oblong, compressed: lvs. solitary, 6 in. long, linear, obtuse, keeled: scape $1\frac{1}{2}$ -2 in. long; fls. nearly 2 in. across; sepals ovate-lanceolate, dirty yellow outside, red-purple within, with a yellow margin and spotted below; petals smaller, colored like the sepals; labellum without lateral lobes, oblong-obtuse, yellow with red-brown spots, and an ill-defined callus on the base. April. Guatemala and Venezuela. B.M. 7533.—Fls. last about a month in the coolhouse.

12. *variabilis*, Batem. (*M. angustifolia*, Hook.). Pseudobulbs oval, compressed: lvs. solitary, plane, linear-oblong, obtuse or emarginate: fls. solitary, small, deep purple; sepals linear-oblong, acute, the lateral ones produced at the base; petals subsimilar; labellum oblong, retuse, fleshy, membranous at the base; disk with a small callus. Midwinter. Mex. B.M. 3614 (as *M. Henckmanni*).—A small plant, of interest only to collectors.

13. *tenuifolia*, Lindl. Rhizomes erect, bearing ovate-compressed pseudobulbs at irregular intervals: lvs. linear-lanceolate, acute, recurved, grass-like, plane: fls. small, spotted and shaded with purple and yellow; sepals ovate-lanceolate, margins revolute, reflexed; petals ovate, acute, erect; labellum oblong, reflexed, with an entire, oblong callus. Spring. Mex. B.R. 25:8.—Not valuable.

M. abbreviata, Reichb. f. Fls. solitary, on long bracted peduncles, copper-colored. O. 1911:106.—*M. Binotti*, De Wild. Peduncles solitary or geminate: fls. yellow; lip densely purple-dotted toward the middle. Brazil.—*M. dichroma*, Rolfe. Related to *M. venusta*, but the petals suffused on the lower half with light pinkish purple, the lip margined, with same color; sepals white.—*M. Fletcheriana*, Rolfe. A new species intermediate between *M. Sanderiana* and *M. grandiflora* in the form and size of fl.: fls. large, cream-white, with purple lines; lip yellow. Peru.—*M. fractiflexa*, Reichb. f. Sepals

yellow, bronzy-tinged, twisted; petals cream-colored, twisted and coiled, warty-margined; lip white, purple-marked. Ecuador. G.C. III. 31:359.—*M. funerea*, Lindl. "Fls. with broad purple-brown sepals and petals, and a darker shining lip, having a broad crest." Brazil.—*M. Fuerstenbergiana*, Schlecht. Fls. large, snow-white, front part of sepals orange-yellow; middle lobe of lip bordered with red. Peru. O. 1912:116, desc.—*M. Hennickeana*, Schlecht. Fls. yellowish white, fragrant. Colombia. O. 1912:117, desc.—*M. incarnata*, offered by Lager & Hurrell, a trade name only.—*M. iridifolia*, Reichb. f. Lvs. distichous, equitant, lanceolate, acuminate; sepals triangular; lip ligulate-pandurate. Colombia.—*M. Johniana*, Kränzl. Scape 1-fl.; fls. widely expanded, white; sepals and petals deep lilac in upper half; lip yellowish, edged with lilac. Peru.—*M. phanicantha*, Rodrig. Fls. white or pale yellow, dotted with purple. Brazil.—*M. pilla*, Lindl. & Reichb. f. Plant small: fls. straw-yellow, striped with red-brown. Colombia.—*M. pusilla*, Rolfe. Scapes solitary, short; sepals and petals brownish green; lip dark purple, shiny.—*M. scurilis*, Rolfe. Sepals and petals elongated, narrow, curved, dark-spotted, 5-6 in. long. G.C. III. 28:65; 32:243, 245.

HEINRICH HASSELBRING.

GEORGE V. NASH.†

MAXIMILIANA (after Maximilian Joseph, first king of Bavaria, 1756-1825, not Prince Maximilian Alexander Philipp, as said by some). *Palmaceæ*, tribe *Attaleæ*. Tall pinnate-leaved palms, spineless, with ringed trunks. Known also as *Englerophoenix*; see *Maximiliana*, below.

Leaves with linear pinnae in groups, the midveins and transverse nerves prominent; rachis bifacial, strongly



2338. *Maxillaria Houtteana*. ($\times \frac{1}{3}$)

compressed; petiole plano-convex. This genus is distinguished from *Attalea* as follows: petals of the male fls. minute, much shorter than the 6 exerted stamens: fr. 1-seeded: pinnae in groups instead of equidistant. From *Cocos* and *Scheelia* it differs in the above floral characters and in the plano-convex instead of concavo-convex petioles. Fr. yellow or brown, ovoid, with fibrous or fleshy pericarp and bony endocarp, the latter 3-pored at the base, acuminate at the apex.—Species 3, St. Kitts, Trinidad and S. Amer. For cult., see *Palms*.

A. *Pinnae verticillate at least on some part of the rachis.*

Maripa, Drude (*Attalea Maripa*, Mart. *Englerophoenix Maripa*, Kuntze). St. thick, very tall: lvs. 15 ft. long; segms. sword-shaped, acute, divaricate, the lower 3 ft. long, 2 in. wide, gradually diminishing upward; spadix and spathe very woody, the fls. very large for a palm, frequently $\frac{3}{4}$ in. long. Brazil.



2339. *Maximiliana regia*.

AA. *Pinnae in opposite clusters.*

régia, Mart. (*Attalea amygdalina*, HBK. *Englerophoenix régia*, Kuntze). Fig. 2339. St. 15–20 ft. high, 12–16 in. thick at the base, 3 times as thick above because of the persistent petiole bases: lvs. 15 ft. long; segms. more slender, papery, disposed in opposite clusters, the upper as broad as the lower: spadix about 12 in. long, the stalk stout: fls. showy and the fibrous fr. about 2 in. long. Brazil. G.C. III. 1: suppl. Feb. 12.

N. TAYLOR.†

MAXIMILIÂNEA. *Bixaceae*. An unfortunate confusion has arisen in the application of this name. As *Maximiliana* (1821), it is accepted for a genus of palms (see above); under the slight variation *Maximiliana* (1819), it is adopted by Warburg in Engler & Prantl, III. 6:312, for the bixaceous genus usually known as *Cochlospermum* (Kunth, 1822). Different ways out of the difficulty have been suggested. One is to supplant the palm *Maximiliana* with a new name (*Englerophoenix*), and to hold *Maximiliana* in place of *Cochlospermum*. Another is to allow the palm name to stand, being well established, and for the bixaceous plants to fall back on *Cochlospermum*; this conforms better to usage and is the more practicable. (See Engler & Prantl, Nachtr. 1. 56; O. Kuntze, Rev. Gen. Pl. I. 44.) Still another is to allow both the Maximilian genera to stand, seeing that they are differently spelled; but they are so near alike that conflict would result. Another alternative is to revise the name *Wittelsbachia* (1821) for *Cochlospermum*, seeing that the latter is antedated by the *Cochlospermum* of Lagasca (1818); but this way of escape need not concern us here. *Cochlospermum* is retained in the "nomina conservanda" of the Vienna Code. Recent authorities make the genus the type of the family *Cochlospermaceae*.

Maximiliana, or *Cochlospermum*, comprises about 12–15 trees, shrubs and subshrubs in tropical and sub-tropical regions of both hemispheres, little known as horticultural subjects: lvs. alternate, digitate or palmately parted: fls. large and showy, yellow, pedicelled,

in fascicles, racemes or panicles from the upper axils or terminal, perfect; sepals 5, unequal, imbricate; petals 5, large; stamens very many, free, with long anthers; ovary 1-celled, with 3–5 placentae, the style undivided and slender: caps. 3–5-valved, with numerous seeds.

M. hibiscoides, Kuntze, *Cochlospermum hibiscoides*, HBK. (*C. serratifolium*, DC.). Shrub: lvs. palmatifid into 7 long-acuminate sharply serrate lobes lighter colored on the under side, the basal lobes small: fls. very large and showy, yellow, with oval or obovate deeply notched petals; the numerous stamens incurved into a ball-like body in the center. S. Mex. to Colombia, W. Indies.—Offered in S. Calif. Hemsley's plate (Biol. Cent.-Amer.) shows a brilliant fl. 6 in. across.

M. Gossypium, Kuntze, or *Cochlospermum Gossypium*, DC. (*Bombax Gossypium*, Linn.), is apparently not in the trade, although recorded in horticultural literature. India: a small unarmed tree: lvs. palmately 3–5-lobed, with slender petiole, acute lobes, tomentose beneath: fls. 4–5 in. diam., golden yellow, in few-fl. terminal panicles; petals obovate, notched: caps. 2–3 in. long.

L. H. B.

MAXIMOWICZIA: *Schizandra*.

MAY APPLE: *Podophyllum*; also *Passiflora*.

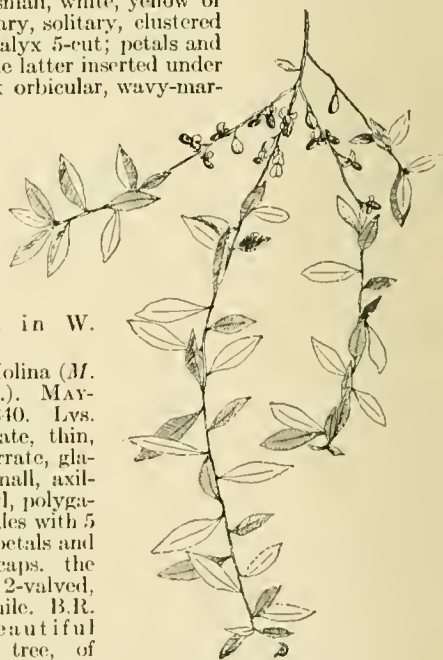
MAYBERRY, JAPANESE GOLDEN: *Rubus palmatus*.

MAYFLOWER of English literature is the same as the hawthorn, *Crataegus Oxyacantha*; of New England is *Epigaea repens*; of the more western states, *Hepatica*.

MAYTÊNUS (from a Chilean name). *Celastraceae*. Trees and shrubs in tropical and temperate America, one of which is cultivated.

Botanically they are near the common bittersweet, *Celastrus scandens*. Aside from habit, Maytenus differs from *Celastrus* in having the ovary confluent with the disk instead of free, and the cells are mostly 1-ovuled instead of 2-ovuled. It consists of evergreen, unarmed plants: lvs. alternate, often 2-ranked, stalked, leathery, serrate: fls. small, white, yellow or reddish, axillary, solitary, clustered or cymose; calyx 5-cut; petals and stamens 5, the latter inserted under the disk; disk orbicular, wavy-margined; style none or columnar: caps. leathery, loculicidally 2–3-valved. —Species 70 or more, S. Amer., tropical and temperate, and in W. Indies.

Boaria, Molina (*M. chilensis*, DC.). **MAYTEN.** Fig. 2340. Lvs. ovate-lanceolate, thin, glandular-serrate, glabrous: fls. small, axillary, clustered, polygamous, the males with 5 calyx-teeth, petals and stamens: caps. the size of a pea, 2-valved, 2-seeded. Chile. B.R. 1702.—A beautiful evergreen tree, of graceful habit; in Calif. 15–25 ft. high, but in



2340. *Maytenus Boaria*, showing the dehiscing fruit.

Chile said to attain 100 ft.: branchlets pendulous; lvs. small; fls. minute, greenish, inconspicuous; aril scarlet. Perfectly hardy in Calif. as far north as San Francisco, and highly valued for ornamental planting; recommended as a street and avenue tree: timber extremely hard. Prop. readily from seeds, which are produced in abundance, or from suckers. J. BURTT DAVY.

MAY-WEED: *Anthemis Cotula*.

MÀZUS (from the *teats* or tubercles in the mouth of the corolla). *Scrophulariaceæ*. A half-dozen low annuals or perennials, seldom grown in rock-gardens and similar places in mild climates. Allied to *Mimulus*, from which it differs in usually having the fls. in subsecund racemes rather than axillary or ordinarily racemed, trailing habit and technical floral characters: lvs. opposite or rosulate, or alternate above, variously toothed or cut; fls. small, bluish or white; corolla-tube short, the upper lip erect and 2-lobed, the throat with 2 projecting protuberances; stamens 4, didynamous; style slender, with 2-lamellate stigma.—Mostly prostrate, creeping or runner-bearing herbs in India, Malay Archipelago, China, Austral., New Zeal.

M. pumilio, R. Br. Small perennial, creeping underground and sending up short close-leafy branches: lvs. tufted, obovate-spatulate, obtuse, entire or somewhat sinuate-toothed; peduncles 1-6 fld., usually exceeding lvs., the fls. bluish or white with yellow center. Austral., New Zeal. Listed as an "alpine."—*M. radicans*, Cheesem. (*Mimulus radicans*, Hook. f.). Very low, the erect leafy branches rising 1-3 in. from creeping or subterranean sts.; lvs. close, 2 in. or less long, obovate to linear-obovate, obtuse, entire or obscurely sinuate; fls. 1-3 on terminal peduncles, $\frac{1}{2}$ - $\frac{3}{4}$ in. long, white with yellow center, the tube much exceeding the calyx. New Zeal.—*M. reptans*, N.E. Br. Tufted perennial, 1-2 in. high, the sts. slender, prostrate and rooting at the nodes: lvs. opposite, lanceolate to elliptic, few-toothed; racemes 2-5 fld., erect; fls. purplish blue with lower lip blotched white, yellow and red-purple: plant somewhat resembling some of the small lobelias. Himalaya. B. M. 8554. G.C. III. 53:210 (as *M. rugosus*).—*M. rugosus*, Lour. Annual, without runners: radical lvs. obovate-spatulate, crenate-dentate; peduncles many from the root, 2-10 in. long; fls. blue. India.

MEADOW BEAUTY: *Rhexia*. **M. Foxtail:** *Alopecurus pratensis* (a meadow grass). **M. Pink:** *Dianthus deltoideus*. **M. Rue:** *Thalictrum*. **M. Saffron:** *Colchicum*. **M. Sweet:** *Filipendula*. **M. Tulip:** *Calochortus*.

MECONÓPSIS (Greek, *poppy-like*). *Papaveraceæ*. Poppy-like herbs, annual and perennial, useful as garden flower plants.

Simple or rarely much-branched plants with yellow juice, annual or biennial (monocarpic: seeding but once) or perennial, with showy large yellow, reddish or blue fls. in cymose racemes or panicles or borne singly: lvs. stalked when radical, short-stalked or sessile when cauline, entire, lobed, or dissected; sepals 2, usually deciduous; petals 4, varying to 5-10; stamens many; stigmas forming a globular mass or body on the several-to many-carpelled ovary: caps. oblong to clavate or even cylindrical, 1-celled with 4 or more projecting placentæ, opening by short teeth or valves at the summit.—Species 28 as defined by Fedde (*Das Pflanzenreich*, hft. 40. 1909), in the northern extra-tropical regions, mostly in Asia, 2 in W. N. Amer.; other species have been described subsequently. In 1906, Prain admitted 27 species (*Ann. Bot.* XX, pp. 323-365).

The species of *Meconopsis* have recently come into much prominence, mostly as herbaceous perennial subjects for borders and rock-gardens. Heretofore these plants have been known mostly by *M. cambrica* and *M. heterophylla*, but within ten or twelve years many attractive species have been introduced from the high elevations in the China-Thibet region. It is probable that the genus will have a great extension of popularity among gardeners. Hybrids already have appeared. Coming from high altitudes, they may be treated as hardy plants. They propagate readily from seed sown directly in the open in spring, or they may be started under glass and transplanted. The annual-biennial species may be carried as seedlings in pots the first summer and planted out in autumn if it is desired to

bloom them the second year. They require partial shade. The Chinese and Himalayan species are essentially alpine, and it is probable that they would not withstand the American summers without very special treatment. Their availability here is yet to be determined.

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A. *Sts. branching: st.-lvs. pinnate or pinnately parted*

B. *Fls. yellow.*

1. *cambrica*, Vig. (*Papaver cambricum*, Linn.). **WELSH POPPY**. Perennial, forming large tufts with thick roots: sts. slender, about 1 ft. high: lvs. long-stalked, pale green, slightly hairy, pinnate, dentate, with 5-7 segms. which are ovate or lanceolate and toothed or pinnately lobed: fls. rather large, long-peduncled, pale yellow: caps. oblong or ovate, glabrous, containing reniform-oval blackish seeds: fls. standing well above the mass of attractive foliage. Rocky woods and shady places. W. Eu. G.C. III. 19:671; 54:52. Var. *flore-pleno*, Hort., is a double-fld. form. It is described as a very showy and worthy plant, with the very double yellow fls. striped scarlet. G.M. 46:373.

2. *chelidonifolia*, Dur. & Franch. Perennial, rhizomatous, glaucous, 2 ft., the st. branching and leafy and glabrous above, at first erect but becoming prostrate: lvs. mostly basal, glaucous beneath, setulose, ovate-deltoid or ovate-oblong, pinnately parted, the segms. ovate and cut with the terminal part 3-lobed: fls. on slender axillary wiry peduncles twice exceeding lvs., clear yellow: caps. ovate, glabrous, small. Cent. Asia to W. China.

BB. *Fls. red.*

3. *heterophylla*, Benth. (*Papaver heterophyllum*, Greene). **WIND POPPY. FLAMING POPPY**. Fig. 2341. Annual, glabrous, 1-2 ft.: lvs. pinnate or pinnately cut, the segms. diverse on the same plant and varying from oval and entire or lobed to narrow-linear: fls. brick-red with darker center, satiny texture; petals broadly cuneate-obovate. Calif., Nev., Ore. G.C. III. 29:413; 55:19.—An attractive plant. Var. *crassifolia*, Jepson (*M. crassifolia*, Benth.). **BLOOD DROPS**. Rather smaller and more branching and bearing more fls.: lvs. mostly radical, smaller and thicker. Calif.

BBB. *Fls. blue.*

4. *Wallichii*, Hook. (*M. Wallichiana*, Hort.). **SATIN POPPY**. Tall, 3-6 ft., somewhat glaucous, making a



2341. *Meconopsis heterophylla*. (× $\frac{1}{2}$)

mound of beautiful cut foliage with rusty hairs, the sts. slender, erect, paniculate: lvs. at base stalked and pinnately parted, the lobes ovate-oblong and sinuate; st.-lvs. sessile, oblong, pinnatifid: fls. satiny, pale blue, with crinkled round-obcordate petals; stamens very many with oblong orange anthers: caps. oblong-elliptic. Mountains (9,000–10,000 ft.), Cent. Asia to W. China. B.M. 4668. F.S. 8:753. G.C. III. 53:147. Gn. 71, p. 626; 73, p. 434; 77, p. 348. G.M. 57:637. R.H. 1912:204. J.F. 3:315. G. 7:449; 31:387.

AA. *Sts. scape-like and simple (or even none), bearing 1 to many fls. at top, more or less leafy: st.-lvs. various.*

B. *Plant with spines or rigid sharp prickles or hairs.*

c. *Lvs. distinctly lobed: fls. blue or purple.*

5. *aculeata*, Royle. Probably perennial, somewhat glaucous, sparsely hispid-aculeate (with short scattered prickles), 1–2 ft., leafy: lvs. remotely irregularly pinnatifid, oblong or lanceolate in outline, segms. broad and variously lobed and obtuse or acute, mostly prickly: fls. slender-pedicelled, 2–3 in. across, blue-purple; petals broadly obovate or obumbrate-rotundate; caps. broadly obconic, obovate or oblong, prickly and bristly and at length becoming glabrous. W. Himalaya, at high altitudes (10,000–15,000 ft.). B.M. 5456. G.C. III. 46:90, 91. Gn. 65, p. 384; 75, p. 226.

6. *sinuata*, Prain. Annual and biennial, prickly, 1–2 ft. or more, the st. leafy: lvs. linear-oblong, obtuse, irregularly sinuate-lobed and the lobes entire, sparsely prickly: fls. pale blue-purple, in few-fl. raceme-like cymes, 2–3 in. diam.: caps. narrow, sparsely prickly. E. Himalaya. Var. *latifolia*, Prain, is the form in cult. It is very like *M. aculeata*, but differs in less-lobed lvs., deep pink or orange rather than pale green stigma, and caps. longer. plant 1–4 ft., with spreading prickles: lvs. oblong, about 6 in. long and to 2 in. broad, obtuse, irregularly lobed or sinuate; petals $1\frac{1}{2}$ in. long, blue. Himalaya. B.M. 8223. G.C. III. 44:202 (as *M. sinuata*). Gn. 76, p. 316; 78, p. 240.

cc. *Lvs. nearly entire (or not lobed): fls. blue or purple.*

7. *rüdis*, Prain. Annual (monocarpic), prickly, $1\frac{1}{2}$ –3 ft., the spines spreading and pale straw-color, rhizome fusiform: lvs. prickly both sides, oblong-lanceolate, obtuse or acute, almost entire or sparingly toothed, narrowed to a wide petiole, glaucescent beneath: fls. in raceme-like cymes, $2\frac{1}{2}$ in. across, bright blue or pale purple, sometimes flushed with purple; petals 6–8, ovate-oblong, obtuse; stamens numerous, with blue filaments and yellow anthers: caps. subglobose or oblong. S. W. China, 13,000–15,000 ft. B.M. 8568.

8. *racemosa*, Maxim. Very like *M. aculeata*, but with entire lvs.: perennial or biennial with thick elongated root, with yellow prickles, sts. erect or ascending, leafy below, 1–2½ ft.: lvs. glaucous, more or less prickly, the basal ones linear-lanceolate or lanceolate, entire or obscurely sinuate, the st.-lvs. contracted into short winged petiole: fls. deep purple to pale lilac, in long racemose cymes; petals 6 (5–8), obovate, spreading, nearly 1 in. long: caps. with small appressed setae. Cent. Asia to China, 11,000–15,000 ft. altitude. G.C.

III. 42:31; 46:92. G. 34:161. Gn. 68, p. 384; 75, p. 510.—Offered abroad.

BB. *Plant not spiny or prickly, glabrous or only setulose.*
c. *Fls. yellow.*

9. *integrifolia*, Franch. (*Catheartia integrifolia*, Maxim.). YELLOW CHINESE POPPY. Biennial, usually reddish hairy, $1\frac{1}{2}$ –3 ft.: lvs. mostly radical, linear-lanceolate, to 8 in. long, entire: fls. on scape-like sts., many on each plant and a half-dozen open at same time, cup-shaped, very large (4–8 in. across), bright sulfur-yellow or primrose-yellow; petals 5–10, broadly obovate; stigmas very many, large and nearly sessile; style wanting. W. China, Thibet, 15,000 and more ft. altitude. B.M. 8027. G.C. III. 36:240; 46:146; 50: suppl. Nov. 11. G.W. 9:534. G.M. 48:287. G. 27:633; 37:8. Gn. 67, p. 286; 73, p. 299; 78, p. 217. G.L. 20:114. F.S.R. 3:80. Gng. 13:279. A.F. 24:781. (Some of these references may apply to No. 10).—

A remarkable and showy plant, intro. to cult. something more than 10 years ago from the explorations of E. H. Wilson. A good garden subject. A hybrid is announced between this species and *M. grandis*.

10. *pseudointegrifolia*, Prain. Closely related to *M. integrifolia*, with which it has been confused in cult.: differs in all the scapes being radical, simple and 1-fl., the style evident and with a narrower stigma. S. W. Thibet.

cc. *Fls. purple or reddish.*

D. *Proper st. none, the fls. borne singly (sometimes twin) on radical scapes.*

E. *Style none; fls. pink-red.*

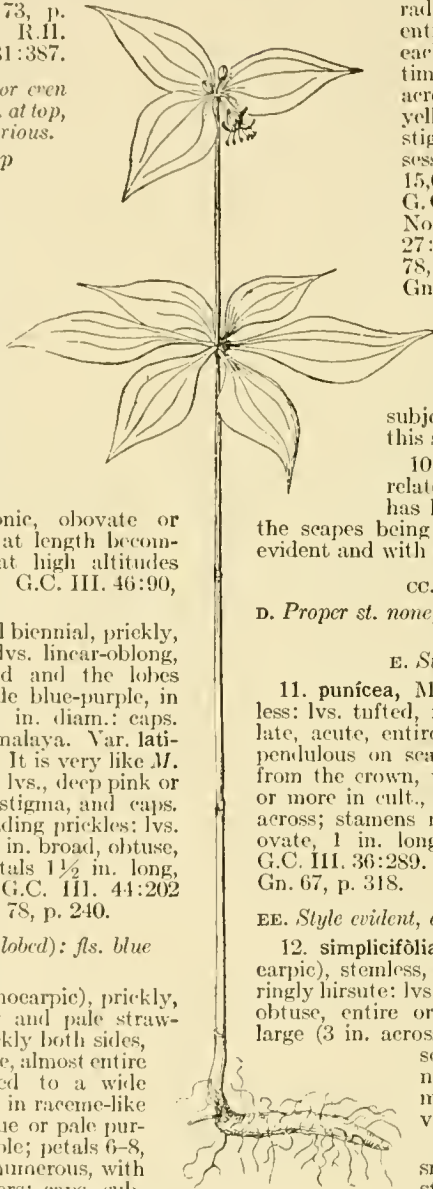
11. *punicea*, Maxim. Annual (monocarpic), stemless: lvs. tufted, radical, sparsely hairy, ovate-lanceolate, acute, entire, tapering to petiole: fls. large and pendulous on scapes 16–20 in. high, arising directly from the crown, very dark pink and showy; petals 4, or more in cult., ovate-oblong, 4 in. long and $2\frac{1}{4}$ in. across; stamens many, the filaments flattened: caps. ovate, 1 in. long. W. China, Thibet. B.M. 8119. G.C. III. 36:289. G.M. 48:315. G.W. 10, p. 273. Gn. 67, p. 318.

EE. *Style evident, even though short; fls. blue and purple.*

12. *simplicifolia*, Don. Annual or biennial (monocarpic), stemless, the foliage radical and tufted, sparingly hirsute: lvs. ovate-lanceolate, acute or somewhat obtuse, entire or toothed, narrowed to petiole: fls. large (3 in. across) and showy, clear blue, on hirsute scapes 12–18 in. high, inclined but not nodding; petals 6–8, ovate; stamens many, with narrow filaments: caps. very narrow. Himalaya. B.M. 8361.

13. *bella*, Prain. Perennial, very small, the radical lvs. only 2–4 in. long; stemless, the rootstock stout and fusiform: lvs. pinnatisect, the segms. small, ovate-oblong: fls. many, on simple 1-fl. scapes 3 in. or less long, pale blue; petals 4 or 5, broadly ovate, $1\frac{3}{4}$ in. long and $1\frac{1}{2}$ in. across; stamens numerous, the filaments blue: caps. $\frac{3}{4}$ in. long, pyriform. Himalaya; local. B.M. 8130. G.C. III. 40:197.

14. *Delavayi*, Franch. Annual (monocarpic), 5–9 in. tall, with long thick and fleshy roots: lvs. all radical, glaucous, lanceolate, attenuate or cordate at base, glabrous above and with sparse colored hairs beneath: fls. solitary on the scapes, half-pendulous, $1\frac{1}{2}$ –2 in.



2342. *Medeola virginiana*—the Indian cucumber-root.
($\times \frac{1}{2}$)

across, deep satiny purple-blue; petals 4 or 5, ovate, obovate or oblong; filaments colored same as petals, anthers orange; caps. 2-3 in. long, on an elongating scape. Yunnan, 11,000-14,000 ft. G.C. III. 50:51. Gn. 77, p. 274.

15. *Hénrici*, Bur. & Franch. Annual or biennial (monocarpic), more or less hairy or sometimes glabrous, low (about 6 in.), the st. very short or practically none, the scapes numerous and 1- or 2-fld.: lvs. linear-oblong or lanceolate, obtuse, entire, attenuate below; fls. large, deep purple-violet, about 3 in. across; petals 6-8; obovate, clawed, spreading; stamens very many, short, the anthers ovate, orange; style slender, exceeding the ovary. W. China.

DD. *Proper st. evident, the flowering branches or peduncles not arising from the base.*

16. *grándis*, Prain. Perennial, 3 ft., pubescent: basal lvs. numerous, somewhat rosulate, ovate-lanceolate, entire or coarsely toothed, the cauline similar and short-stalked or sessile: st. scape-like with fascicled lvs. toward top; fls. 3-5 in. diam., in 3's in umbel-like cymes, brown-purple; petals 6-9; stamens numerous; style short but distinct. Himalaya. G.C. III. 37:369.

M. dissecta, Prain. Probably perennial, with golden brown spreading hairs: lvs. in a basal tuft, spatulate, subacute, sparingly toothed, sometimes lobed toward the apex, green above, glaucous beneath: st. scape-like, simple, 1 ft. high; fls. racemose, the petals and sepals not described; caps. bearing a lobed disk. Himalaya.—*M. Forrestii*, Prain. Allied to *M. lanceifolia*, st. simple; lvs. few, lanceolate or narrow-subspatulate, obtuse or acutish, entire; fls. 3-5, in raceme-like cymes, pale blue; petals oblong. Yunnan.—*M. lanceifolia*, Franch. Annual or biennial, much like *M. Hénrici*, but the deep violet fls. in raceme-like cymes; lvs. narrow-lanceolate or linear-lanceolate, entire or slightly repand; petals broadly obovate; caps. narrow-obconic. China.—*M. nepalensis*, Hort. What the cult. plant passing under this name (variously spelled) may be is uncertain. *M. nepalensis* D.C., is allied to *M. Wallichii*, but with brownish purple larger fls., and sparsely long-pilose herbage. *M. nipalensis*, Hook. f., is *M. robusta*. B.M. 5585. *M. nepalensis*, Lem., is a form of *M. paniculata*; and *M. napaulensis*, Walp., belongs to the same species.—*M. Olfertiana*, Franch. & Prain. Perennial: st. erect, much branched, 2-3 ft.; lvs. numerous, ovate-oblong, pinnately parted; fls. solitary or twin, probably purple, the petals rounded and nearly 1 in. diam. W. China.—*M. paniculata*, Prain. Tall perennial, soft-hairy: st. simple or seldom somewhat branched, bearing yellow fls. in lax raceme-like cymes; lvs. linear-lanceolate or oblong, sinuate lobed, coarsely toothed, or rarely pinnatifid; petals entire. Himalaya.—*M. primulina*, Prain. Annual or biennial, glabrous or sparsely strigose; st. short; lvs. spatulate to linear-oblong, entire; scape nearly radical, 1-fld.; fls. violet-purple, the petals 6-8, the inner ones narrower. Himalaya.—*M. robusta*, Hook. f. & Thoms. Tall annual or biennial, glaucescent, much branched: basal lvs. pinnately parted; fls. racemose or paniculate, sulfur-yellow. Himalaya.—*M. superba*, King. Annual or biennial, tall and stout: basal lvs. sinuate-lobed; st. simple, bearing white fls. in simple raceme-like cymes. Himalaya.

L. H. B.

MEDÉOLA (named after the sorceress Medea, for supposed medicinal virtues). *Liliaceæ*. INDIAN CUCUMBER-ROOT, from the taste of the edible root. One species, a native perennial herb with 2 whorls of lvs. and small not showy fls. It is offered by some dealers in native plants. *Medeola* is allied to *Trillium*, although not suggestive of it in looks. The fls. are umbellate in the upper whorl of lvs., the perianth-segms. all alike, colored and deciduous, stamens 6: fr. a dark, purple few-seeded berry. The *Medeola asparagoides*, Linn., of the older literature, is *Asparagus asparagoides*.

virginiana, Linn. Fig. 2342. St. slender 1-3 ft. high, clothed with flocculent deciduous wool, from a short horizontal rootstock: lower whorl of lvs. 5-9, obovate-lanceolate, pointed, netted-veiny, lightly parallel-ribbed; upper whorl of 3-5, smaller, ovate lvs. at top subtending a sessile umbel of small recurved fls. June. Boggy soil, Nova Scotia to Minn., Ind. and southward. B.M. 1316.

L. H. B.

MEDICAGO (name originally from the country Media). *Leguminosæ*. MEDICK. Forage plants, and a few grown for ornament.

Herbs or rarely shrubs, with small pinnately 3-foliate lvs. and denticulate lfts., and mostly small, purple or yellow fls. in heads or short racemes; stamens 9 and 1,

diadelphous: fr. a small spiral or curved, rough or pubescent indehiscent 1- to few-seeded pod: fl. with an obovate or oblong standard and obtuse mostly short keel.—Species probably 50 in Eu., Asia, Afr. Four or 5 species have become weeds in N. Amer. A few are somewhat cult. for ornament. The one important species, from an agricultural point of view, is alfalfa. One species (and perhaps more) is cult. for the odd pods, which are sometimes used by Old World gardeners as surprises or jokes, and are occasionally grown in this country as oddities. See also *Scorpiurus*. Some of the medicagoes simulate clovers in appearance, but the twisted or spiral pods distinguish them. Aside from the following, 2 or 3 species have been used more or less in this country for forage, as *M. hispida*, Willd., and *M. arabica*, Huds., both yellow-fld. annuals. *M. orbicularis*, All., of S. Eu., a very small-fld., yellow annual species with large smooth pods, may be valuable for forage.

A. Fls. purple.

sativa, Linn. ALFALFA.

LUCERNE. Fig. 2343.

Perennial, glabrous, growing erect 1-3 ft. and making a long taproot: lfts. small, linear, oblong to ovate-oblong, prominently toothed toward the top; stipules awl-like, conspicuous, entire: fls. in short, axillary racemes: pods slightly pubescent, with 2 or 3 spirals. Eu.—Now widely cult. as a hay and pasture plant, being to the W. what red clover is to the N. E.; also important eastward. See *Alfalfa*, and books on forage plants.



2343. *Medicago sativa*—alfalfa. (×1/2)

AA. Fls. yellow.

B. Plant annual and herbaceous.

fulpulina, Linn. BLACK or HOP MEDICK. NONESUCH.

YELLOW TREFOIL. Diffuse, the branches often rooting and becoming 2-3 ft. long, deep-rooted, and difficult to pull up: plant glabrous or slightly pubescent: lfts. oval to orbicular, toothed; stipules broad and toothed; fls. small, light yellow, in pedunculate heads: fr. nearly glabrous, spiral, becoming black. Eu.—Extensively naturalized. It has the appearance of a clover. The yellow clovers with which it is likely to be confounded have larger heads, which soon become dry and papery, and the stipules are entire. It is sometimes used as a forage or hay plant. Of no ornamental value.

prostrata, Jacq. St. prostrate: lfts. linear, dentate at the apex; stipules linear-subulate: pod glabrous, spirally contorted, 2-seeded, black. S. Eu.—Advertised as an ornamental plant. *M. elegans*, a name for a low yellow-fld. plant, may be any one of 4 or 5 species.

scutellata, Mill. SNAILS. Erect or spreading, soft-pubescent: lfts. broadly obovate or the upper ones broadly oblong, prominently toothed; stipules falcate, toothed at the base: fls. small, solitary or nearly so: pod large and prominently reticulated, 1/2 in. across, like a snail-shell. Eu.—Grown for the odd snail-like pods, which are used as surprises. See *Caterpillars*. Probably useful also for forage.

BB. Plant perennial and woody.

arborea, Linn. TREE ALFALFA. MOON TREFOIL. Two to 8 ft. tall, with hard black wood: lfts. oval to obovate, light green, toothed at the top; stipules linear-acute, entire: fls. orange-yellow, in rather loose, axillary,

peduncled clusters; pod spiral, 2-3-seeded. S. Eu. L.B. C. 11:1379.—Offered as an ornamental plant in S. Calif.

L. H. B.

MEDINILLA (after José de Medinilla y Pineda, governor of the Ladrones). *Melastomaceae*. Choice warmhouse plants with showy flowers and often with showy bracts and foliage.

Medinilla is distinguished from allied genera (none of which has garden value) chiefly by the curious appendages of the stamens. The stamens are 8, 10 or 12 (twice as many as the petals), the anterior connective 2-lobed or 2-spurred, the posterior one usually setose or 1-2-lobed or 1-spurred; branching shrubs, erect or climbing; lvs. mostly opposite or whorled, entire, often fleshy; fls. white or rose, with or without bracts, in panicles or cymes; fr. a berry crowned by the calyx-limb.—Species 125 and more, in tropical parts of E. Asia, Afr., and the Pacific region, many of them in the Philippines. Those prominently described below have opposite lvs. and mostly 5-merous fls.

Medinillas are amongst the handsomest and most striking of flowering plants, and being of free growth should be given a place in all tropical collections. To succeed with them, a position affording all the light possible should be given them. However, they will not stand strong sunshine, and it is advisable that they be shaded with cheese-cloth the greater part of the year. If they are grown under a heavy shade, they are not inclined to flower well. Cuttings of half-ripened wood, taken in spring, is the best means of propagation. These may be potted singly, in suitable pots, in a mixture of finely sifted peat and sand, with a little powdered charcoal added. Place them in a tight case, and keep fairly moist, care being taken that the air does not become stagnant. The night temperature should not be less than 70°. The cuttings will be rooted in about a month, when they may gradually be given more air and finally transferred to a position in the tropical house. In the earlier stages of growth, the points of the shoots may be stopped by pinching to encourage breaks. Later on they will branch freely of themselves. A good fibrous loam with a third of sharp sand, adding a little charcoal about the size of beans, is the best potting material. Pot moderately firm, as this tends to

make a shorter-jointed growth and firmer wood, which is indispensable for success in flowering. Three inches of a shift may be given each time they are potted, as they root freely, but strict attention must be given to drainage, as they require plenty of water during their growing season. A night temperature of not less than 68° is necessary while they are in active growth. Syringe freely on all bright days, especially the under side of the foliage, as red-spider is likely to get a foothold. As autumn approaches, gradually lower the temperature to 60° by night, and gradually withhold water, giving just enough to keep the leaves plump. This ripens the wood for flowering. While the flowers are forming, as dry an atmosphere as possible should be maintained. After flowering, the plants may be pruned into shape, and any repotting done that is necessary. Medinillas may be retained in the same-sized pot for years, after they have attained the desired size, by shaking out a portion of the old soil each year, when repotting, and feeding liberally during the growing period with manure water. *M. magnifica* is the handsomest form, but *M. Teysmannii* (*M. amabilis*) is also a fine variety, the panicles being erect instead of pendulous, which is the habit of the former. *M. Curtisii* is quite distinct from the above. It grows well in a greenhouse temperature of 50° to 55° and begins to flower in the fall, lasting through the winter. The leaves are much smaller than in the above two species. It makes an excellent bush plant and should be better known. Mealy-bug and scale are liable to attack the plants and they must be kept in check as soon as detected. (George F. Stewart.)

A. Fls. coral-red or rosy pink.

magnifica, Lindl. Figs. 2344, 2345. Evergreen shrub: lvs. with 9-13 nerves, which run from various points along the midrib to the margin or apex, ovate or ovate-oblong; bracts 1-4 in. long. Philippines. B.M. 4533. F.S. 6:572; 9:968 (splendid). Gn. 51, p. 394. G.C. II. 2:421; III. 49:226. R.B. 33, p. 72; 36, p. 54. G. 31:357. J.F. 1:56, 57; 3:298. G.W. 1, p. 6; 10, p. 431. R.H. 1857, pp. 319, 343; 1896, pp. 102, 103. A.F. 7:1047.—Other interesting features are the whorled branches, each one 4-ridged or winged, and the dense ring of short fleshy processes at the joints between the lvs. It can be prop. by seeds or cuttings of young wood in heat. *M. magnifica* is one of the most gorgeous tropical plants in cult. It has handsome broad, shining, leathery foliage and coral-red 5-petaled fls., each about 1 in. across, which are borne in pendulous pyramidal panicles sometimes a foot long, and bearing 100-150 fls. The axis and branches of the panicle are pinkish, and the same color tinges the large showy bracts, which are sometimes 4 in. long. Hooker says: "Its most beautiful state is, perhaps, before the full perfection of the fls., when the large imbricated bracts begin to separate and allow the buds to be partially seen. As the expansion of the blossoms advances, the upper bracts fall off, but the lower ones remain and become reflexed." This remarkable plant flowers copiously when only 2 or 3 ft. high, and a large well-kept specimen in bloom is a worthy ambition of a gardener. The numerous long bent purple anthers, with their yellow filaments, form an additional feature of interest.

Teysmannii, Miq. (*M. amabilis*, Dyer). Exceeds *M. magnifica* in size of fls., but lacks the beautiful colored bracts: glabrous: sts. with 4 crisped or crenulate wings: lvs. very large (12 in. long and 6-8 in. wide), sessile, obovate-oblong or elliptic-oblong, acute and often concave, wavy-margined, 5-nerved: panicle pyramidal, erect, bracts none; fls. rose-colored, 1½-2 in. diam.; calyx truncate or obscurely lobed; stamens 10, upcurved, with pale violet anthers. Celebes, New Guinea. B.M. 6681. G.C. II. 1:373; 17:561.

javanensis, Blume. Erect shrub or tree with smooth 4-sided branches: lvs. large, sessile, elliptic-ovate,



2344. *Medinilla magnifica*. A young specimen.

5-nerved, entire, acute, tinged red beneath; panicle small and compact, lateral and terminal, the bracts small and deciduous; fls. pale rose-color; petals obovate; calyx turbinate, with minute teeth; filaments white and anthers dark purple. Java. B.M. 4569. J.F. 1:96.

AA. *Fls. white.*

Curtisii, Hook. Shrub with slender drooping branches: lvs. with 2 nerves beside the midrib which run from the base to the apex of the lf., sessile, oblong or ovate-oblong, acuminate: bracts minute, at the base of the spreading branches: fls. ivory-white, with purple anthers, to $\frac{2}{3}$ in. across; calyx globose and fleshy, with a short limb, petals nearly orbicular. Sumatra. B.M. 6730. G.C. II. 20: 621. G.Z. 28, p. 194.

chionantha, Stapf. Glabrous shrub with terete gray-brown branches: lvs. lance-oblong, acuminate, narrowed into a very short decurrent petiole, 3-nerved: cymes axillary, somewhat umbellate, the

2345. *Medinilla magnifica*. ($\times \frac{1}{2}$)

bracts minute and acute; fls. snow-white; petals broadly elliptic, obtuse, fleshy, $\frac{2}{3}$ in. long. Malay Peninsula.

There are many beautiful plants in this genus, but only a few of them are in cult. The following may be expected: *M. Sieboldiana*, Planch. Lvs. oblong, fleshy, opposite, strongly 5-nerved: fls. white, $\frac{3}{4}$ in. across, with purple stamens, in a drooping panicle. Moluccas. B. M. 4650. R. B. 36, p. 38.—*M. speciosa*, Blume. Dichotomous or trichotomous, the branches 3- or 4-angled: lvs. mostly whorled, nearly sessile, oval or oval-oblong, 5- or 7-nerved: fls. rose in a dense terminal panicle. Java. B. M. 4321. F. S. 5:482.—*M. venosa*, Blume. Branches terete: lvs. relatively small, short-petioled, oblong-acute, 7-nerved, rusty colored above, opposite: fls. rose-color, in few-fld. cymes: petals oblique-obovate, acute. Malaya. R. B. 36, p. 38.

WILHELM MILLER.

L. H. B.†

MEDLAR: *Mespilus*.

MEGACLINIUM (Greek, *large bed*, because of the ample rachis). *Orchidaceae*. About 50 species of African epiphytic orchids, nearly all tropical, requiring the treatment given *Bulbophyllum*, which they resemble in habit but from which they are distinguished by having the bracts and fls. attached on either side a flattened rachis and the lateral sepals shorter than the curved free dorsal sepal: herbs with strong creeping rhizome, pseudobulbs usually globose or ovoid and bearing 1 or 2 lvs.: fls. small, yellowish, brownish, purple, variously spotted, on the almost leafy end of the scape that arises from the base of the pseudobulbs; petals smaller and narrower than the sepals; lip jointed to the foot of the column, mobile, entire, denticulate or 3-lobed; column short, winged on both sides: scape usually only a few inches high, sometimes 18 in.

M. bufo, Lindl. (*Bulbophyllum bufo*, Reichb. f.). Rachis green, long-linear, 8-9 in. long and $\frac{1}{2}$ in. wide, bearing small brownish fls. with darker spots; lip dark purple, flat, the base ovate-orbicular. Sierra Leone. G. C. 1841:348.—*M. Clarkei*, Rolfe. Rachis light green in center and margined and spotted purple-brown, 6-7 in. long, falcate-ensiform, obscurely repand-crenulate: fls. purple-brown speckled on green; lip recurved, the base ovate. W. Trop. Afr.—*M.*

eburneum, Pfitz. Scape as long as lvs., and rachis as long as scape and irregularly dilated: fls. and rachis yellowish white; ends of petals and the dorsal sepal yellow. W. Afr.—*M. falcatum*, Lindl. (*Bulbophyllum falcatum*, Reichb. f.). Rachis brown-green, linear-oblong and somewhat falcate, acute, thin-margined, 2-4 in. long; fls. dark brown-red on upper parts and greenish yellow on lower segms.; lip triangular oblong, obtuse. Guinea. B. R. 989.—*M. leucorhachis*, Rolfe. Rachis white, $\frac{1}{2}$ in. broad and 3 in. long, falcate-ensiform, obscurely crenulate: fls. velvety yellow; lip recurved, the broad base sinuate. Upper Guinea. B. M. 7811.—*M. lutescens*, Rolfe. Scape less than 2 in. long; rachis very narrow, $1\frac{1}{4}$ in. or less long; fls. honey-yellow, small and nearly sessile; resembles *M. minutum*, but the rachis much narrower and the dorsal sepal acuminate. W. Afr.—*M. maximum*, Lindl. Rachis purple, 4-5 in. long and $\frac{1}{2}$ in. wide, ensiform, undulate, the scapes 1-1 $\frac{1}{4}$ in. long with tubular sheaths: fls. purple; lip oblong, obtuse, the base broad and denticulate. Guinea. B. M. 5936 (as *M. purpuratum*).—*M. minutum*, Rolfe. Very small, the scape only $1\frac{1}{2}$ in. long, the rachis purple-brown, oblong, crenulate, bearing about a dozen blooms: fls. dull maroon and greenish yellow, fleshy; lip cordate-ovate, obtuse, reflexed at apex. Upper Guinea. B. M. 7314.—*M. platyrhachis*, Rolfe. Rachis much dilated, 4-6 in. long and 1 in. broad, crenulate, greenish yellow, spotted white and brown, lengthening in bloom: fls. many, yellow-green; lip fleshy and tongue-shaped, recurved, the lateral lobes small. Cent. Afr. B. M. 7946.—*M. purpuratum*, Lindl.—*M. maximum*.—*M. purpureorhachis*, Wildm. Large, the scapes lateral and stout, 12-14 in. long; rachis broad and flat, undulate and slightly twisted, purple-spotted: fls. brown, velvety outside; lip orbicular-ovate, recurved and obtuse, flattened. Congo. B. M. 8273.—*M. scaberrimum*, Rolfe. Rachis dull white, shaded green and marked purple: fls. dull purple, the sepals shaded whitish green at base. S. W. Extra-trop. Afr.—*M. ugandae*, Rolfe. Scape about 5 in. long; rachis oblong, half length of scape, light green and heavily marked with purple-brown: fls. small, with light green petals and sepals similar in coloring to the rachis. Uganda.

L. H. B.

MEGARRHIZA: *Echinocystis*.

MEGASEA: *Sarifruga*.

MEIBOMIA: *Desmodium*.

MELALEUCA (Greek, *mclas*, black, and *leukos*, white; from the black trunk and white branches of one of the species). *Myrtaceae*. Shrubs and trees, often with showy bloom, of high ornamental value for warm temperate regions; especially useful where drought-resistant shrubs are needed.

Leaves alternate, rarely opposite, entire, lanceolate or linear, flat or subterete, with 1-3 or many nerves: fls. in heads or spikes, rarely scattered, each sessile in the axil of a floral lf., their parts in 5's; calyx-tube subglobose; lobes imbricate or open; petals spreading, deciduous; stamens indefinite in number, more or less united at their bases into 5 bundles opposite the petals; anthers versatile, the cells parallel and bursting longitudinally; ovary inferior or half-inferior, inclosed in the calyx-tube, usually with many ovules in each cell; maturing into a persistent caps. Related to *Callistemon* but distinguished by the united filaments: shares with that genus the name of bottle-brush.—About 100 species of Australian shrubs and trees, some inhabiting salty ground and swamps, others occupying semi-arid slopes of the interior. Grown as specimen and lawn plants, the larger species also for street trees in Calif. and Fla.: *M. Leucadendron* and *M. cricifolia* are recommended for fixing muddy shores and for planting in alkaline soils. The timber is close-grained, hard, and durable. Sixteen species are described and figured in Univ. Calif. Pub. Bot. 4:27-34. For cult. see *Callistemon*.

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A. Infl. a cylindric spike (rarely head-like in Nos. 5 and 11), or fls. somewhat scattered.

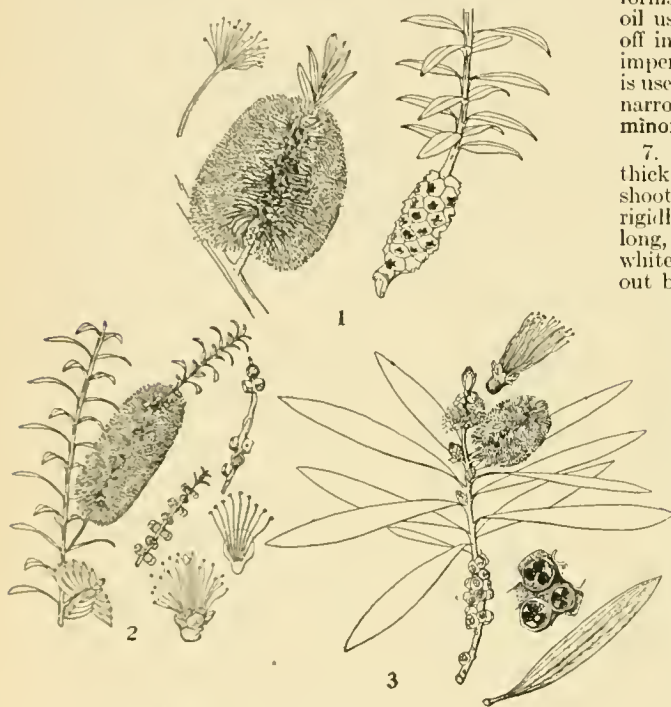
B. Fls. red or scarlet.

1. *hypericifolia*, Smith (*M. oppositifolia*, Hort.). Fig. 2346. Tall glabrous shrub: lvs. opposite, lanceolate or

oblong, $\frac{3}{4}$ – $1\frac{3}{4}$ in. long, with prominent midrib and dots beneath: fls. rich red, in spikes 2 in. long and about as wide, the axis growing out as a leafy shoot; stamens $\frac{3}{4}$ –1 in. long, including the claw of about $\frac{1}{2}$ in.: fr. sessile by a broad base. May–Oct. L.B.C. 2:199.—One of the most popular, with pleasing foliage and gorgeous bloom.

2. *lateritia*, Otto. Graceful shrub with many slender branches, 6–12 ft.: lvs. alternate, linear, acute, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, quite nerveless: fls. rich scarlet, in cylindric spikes about $2\frac{1}{2}$ in. long and forming the base of leafy branches; stamens $\frac{3}{4}$ in. long, the claw very short: fr. sessile.—Grown for its graceful habit and for the soft color of its fls.

3. *Wilsonii*, F. Muell. Tall elegant shrub, glabrous or slightly pubescent: lvs. opposite, imbricate on twigs,



2346. *Melaleucas*: 1, *M. hypericifolia*; 2, *M. decussata*; 3, *M. Leucadendron*.

linear, acute, $\frac{1}{4}$ – $\frac{1}{2}$ in. long: fls. red, scattered or in loose spikes; stamens $\frac{1}{2}$ in. long: fr. sessile. B.M. 6131.

BB. Fls. white, blue, lilac, or pink.

c. Lvs. mostly opposite.

4. *linariifolia*, Smith. Tall shrub or tree, pubescent only on young parts: lvs. rigid, broad-linear, acuminate, mostly $1\frac{1}{4}$ in. long, the midrib prominent beneath: fls. white, in pairs in spikes $1\frac{1}{2}$ in. long, these at first terminal but the shoot soon continuing; stamens $\frac{1}{2}$ – $\frac{3}{4}$ in. long, the long claws emitting short filaments along their entire length: fr. narrow at base but sessile.

5. *decussata*, R. Br. Fig. 2346. Spreading shrub, to 20 ft., bright green and glabrous: lvs. lanceolate to oblong, narrowed at base, $\frac{1}{4}$ – $\frac{1}{2}$ in. long, 1 line wide: fls. lilac, in cylindric spikes 1 in. or less long, the axis growing out as a leafy shoot, or the clusters globose and lateral or terminal when the fls. are sterile; stamens $\frac{1}{4}$ in. long, very shortly united in bundles of 10–15: fr. broad at base, partly embedded in the thickened rachis. B.M. 2268. L.B.C. 13:1208.—Grown in large grounds, where the spreading branches and pendulous twigs may develop to best advantage.

cc. Lvs. mostly alternate or spiral.

d. Length of lvs. mostly over $\frac{1}{2}$ in.

6. *Leucadendron*, Linn. (*M. Cajuputi*, Roxbg. *M. latifolia*, Rausch). CAJUPUT TREE. PUNK TREE. SWAMP TEA TREE. Fig. 2346. Large tree with thick spongy bark and pendulous branchlets (branches rigid and erect in small plants), either glabrous or the young shoots silky: lvs. elliptic or oblong, tapering to each end, 2–4 or 8 in. long, $\frac{1}{2}$ – $\frac{3}{4}$ in. wide, with 3–7 parallel nerves and numerous cross-veinlets: fls. creamy-white (varying to pink and purple in Austral.); the spikes $1\frac{1}{2}$ –4 in. long, 1 in. wide, the axis growing out only after flowering; stamens nearly $\frac{1}{2}$ in. long. June–Oct. G.M. 40:798. Bot. Cook's First Voy. 112. Maiden, For. Fl. N. S. W. 15.—This tree withstands salt-water, wind, drought, and slight frosts. The lvs. of certain forms yield the well-known green aromatic cajuput oil used in medicine. The bark is pale buff and peels off in many thin layers; it is very durable and almost impervious to water; it is valuable for packing frs. and is used for roofs and boats. A low, pyramidal form with narrow lvs. and silky fls. is sometimes listed as var. *minor*, Hort.

7. *stypelioides*, Smith. Becoming a tall tree, with thick spongy bark, glabrous except the silky young shoots and infl.: lvs. ovate, sessile by a broad base, rigidly acuminate, often somewhat twisted, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, nearly $\frac{1}{4}$ in. wide, many-nerved: fls. creamy white, in dense spikes 1 or 2 in. long, the axis growing out before flowering is over; stamens 4 lines long: fr. globose, crowned by the persistent calyx-teeth.—Grown at San Diego; a subject worthy of much wider use.

8. *armillaris*, Smith (*M. alba*, Hort.). Tall graceful shrub with slender leafy twigs, glabrous throughout: lvs. narrowly linear, $\frac{1}{2}$ – $\frac{3}{4}$ in. long, not 1 line wide, the tip very slender and usually curved: fls. white, in cylindric spikes often 2 in. or more long, the axis protruding and leafy before the buds open; stamens $\frac{1}{4}$ in. long, the ribbon-like claw about equaling the distinct filaments: caps. with broad base partly embedded in the rachis. Bot. Cook's First Voy. 114.—The best of the white-fl. melaleucas, especially because of its slender drooping branchlets and absence of barren twigs. The knotted fr.-clusters, so objectionable in some species, are not evident in this.

DD. Length of lvs. mostly $\frac{1}{2}$ in. or less.

9. *parviflora*, Lindl. (*M. Preissiana*, Schau.). Tree or tall shrub, glabrous or the young parts pubescent: lvs. thick, rigid, lanceolate or broadly linear, very acute, about $\frac{1}{2}$ in. long, the nerves obscure: fls. white, in loose spikes 1 in. or less long: fr. globose, narrowed to the base. June–Oct.—*M. armillaris* and *M. ericifolia* are often erroneously labeled *M. Preissiana* in Calif. gardens and nurseries.

10. *Huëgelii*, Endl. Erect rigid shrub, 6–15 ft., nearly glabrous: lvs. spirally arranged, appressed, overlapping, sessile, ovate, acute, $\frac{1}{4}$ in. or less long, striate with 3–7 nerves: fls. white (or buds pink), in dense spikes 1–5 in. long by about $\frac{3}{4}$ in. wide, the rachis growing out before the buds open; stamens 4 or 5 lines long, the conspicuous claw ending in 7–11 filaments: frs. globose, with broad base partly embedded in the rachis, crowded into a cylindric spike.—Interesting chiefly because of its oddity.

11. *ericifolia*, Smith. Small tree, either glabrous or pubescent, the bark thick and soft: lvs. not rigid, usually recurved from the middle, narrowly linear or nearly cylindric, rather obtuse, about $\frac{1}{2}$ in. long: fls. yellowish white, the spikes $\frac{1}{2}$ –1 in. long and less than $\frac{1}{2}$ in. wide, the rachis soon growing out, or the sterile fls. in nearly globular terminal heads; stamens $\frac{1}{4}$ in.

long, each claw bearing about 7 terminal filaments: fr. with broad base partly embedded in the rachis.—Resembles an arboreous heath. Used to a limited extent in Calif. as a lawn tree.

AA. Infl. a terminal globose head, the rachis seldom growing out until after flowering.

12. *nesóphila*, F. Muell. Glabrous shrub or tree, to 35 ft., with thick spongy bark exfoliating in broad strips: lvs. alternate, thick, obovate-oblong, obtuse but often mucronate, $\frac{1}{2}$ –1 in. long, about $\frac{1}{4}$ in. wide, obscurely 1- or 3-nerved: fls. pink or rose-color, the heads 1 in. or more thick; stamen-claw short: frs. smooth, congested in knot-like masses. May–Sept.—A very rapidly growing species used for large shrub-beries and (in S. Calif.) for shade above seats in parks. The persistent caps. are unsightly in small grounds.

13. *nodosa*, Smith. Tall, nearly glabrous shrub: lvs. nearly awl-like, rigid, straight, $\frac{1}{2}$ –1 in. long: fls. pale yellow, in many small heads scarcely $\frac{1}{2}$ in. thick: frs. in small inconspicuous heads. Bot. Cook's First Voy. 115.

14. *incana*, R. Br. Tall shrub, the young twigs, flowering branches, and young lvs. ashly-pubescent: lvs. alternate, rarely opposite, spreading, linear to lanceolate, acute, $\frac{1}{4}$ – $\frac{1}{2}$ in. long, mostly 1-nerved: fls. yellowish white, in dense ovoid or oblong spikes about $\frac{3}{4}$ in. wide; stamens shortly united in bundles of 3–9: frs. in dense cylindric spikes $\frac{3}{4}$ –1 in. long. B.R. 410.

M. fulgens, R. Br. Stands next to *M. lateritia* in botanical characters but lvs. mostly opposite: fls. dark red; stamens 1 in. long, the ribbon-like claw splitting into numerous filaments. B.R. 103. R.H. 1895:232.—*M. genistifolia*, Smith. Near *M. lateritia*: lvs. alternate, narrow-lanceolate, rigid, the upper finely striate: stamens about $\frac{1}{4}$ in. long.—*M. micromeria*, Schan. Stands next to *M. incana*: lvs. minute, scale-like, densely clothing the st. Once grown at Santa Barbara.—*M. tenella*, Benth. Near *M. nodosa*: lvs. scattered or in 3's, linear, $\frac{1}{4}$ in. long: stamens about 2 lines long.

HARVEY MONROE HALL.

MELÁNTHIUM (Greek, *black flower*; from the color which the persistent perianth assumes on fading). *Liliaceæ*. Leafy perennial herbs 2–5 ft. high, with thick rootstocks: lvs. linear to oblanceolate, the lower ones sheathing: fls. greenish, white or cream-colored, borne in a large open terminal panicle; segms. of perianth 6, separate, clawed, biglandular; stamens adnate to segms.; styles 3, subulate: fr. a 3-celled caps.—Species 4, E. U. S.

virginicum, Linn. BUNCH-FLOWER. St. rather stout, to 5 ft., leafy: lvs. linear, 1 ft. or less long: panicles 6–18 in. long; fls. 6–10 lines across, greenish yellow, double gland at top of claw. July. Marshy woodlands and meadows from New England to Fla. and Minn. to Texas. B.M. 985 (as *Helonias virginica*).—A showy and striking plant, good for bog-planting and colonizing. The other species appear not to have been offered in the trade.

L. H. B.

MELASPHËRULA (a little black sphere; referring to the bulblets or the seeds). *Iridaceæ*. One species from the Cape of Good Hope, a small bulbous plant procurable from Dutch bulb-growers. It belongs to the *Ixia* tribe, in which the fls. are spicate, not fugitive, and never more than 1 to a spathe. It resembles *Ixia* in having a regular perianth and simple style-branches, but belongs to a different group of genera in which the stamens are 1-sided and arched. Perianth slit nearly to the ovary, the segms. oblong-lanceolate or lanceolate and very acuminate; stamens short, attached in base of perianth; style short and filiform: caps. 3-lobed, loculicidal. Treated as *ixias* in cult.

graminea, Ker (*Glabolus gramineus*, Linn. f.). Corm globose, $\frac{1}{2}$ in. diam.: st. very slender, 1 ft. or more long: lvs. about 6 in a 2-ranked, basal rosette, linear, $\frac{1}{2}$ –1 ft. long: spikes few-fl'd., paniced; fls. yellowish green, veined with purplish black, $\frac{1}{2}$ – $\frac{3}{4}$ in. across. Spring. Coast region of S. Afr. B.M. 615.

L. H. B.

MELÁSTOMA (Greek for *black and mouth*; said to allude to the color left in the mouth when the berries of some species are eaten). *Melastomaceæ*. Woody greenhouse plants.

This genus, which gives name to the great family Melastomaceæ, with more than 2,000 species, is little known in cult. It is not the most important genus of the family, either horticulturally or in number of species. Cogniaux (DC. Monogr. Phaner. 7) admits 37 species. The larger part of melastomaceous plants are of Trop. Amer., but the true melastomas are natives to Trop. Asia, Austral. and Oceanica. They are shrubs or rarely small trees: lvs. opposite, petiolate, oblong or lanceolate, thick and entire, strongly nerved lengthwise, often handsomely colored: fls. solitary or fasciated on the ends of the branches, purple or rose (rarely white), large and showy; calyx mostly 5-lobed; petals usually 5 and often unequal, ciliate on the back; stamens 10 as a rule, very strongly unequal, part of them being short and small: fr. a leathery or fleshy berry, breaking irregularly, 5–7-loculed, with many small spiral seeds. Nearly all tropical melastomaceous plants require a high temperature, partial shade and considerable moisture.

The melastomas are seldom seen in greenhouses, yet on account of the showy flowers of some of the species all representative collections of plants should have a few of them. The plants known under this name to gardeners are likely to belong in part to other genera (specially to *Miconia*) but they agree in cultural requirements. They are not difficult to grow, and a little effort bestowed on them will repay the grower when flowering time arrives. Cuttings may be secured from the half-ripened wood in spring. The best way is to place each one in a small pot, in equal parts of peat and sand. Plunge the pots in a bed with 70° to 75° of bottom heat, keeping them shaded from the sun. It is better to inclose them in a tight frame, or case, to avoid draughts. When rooted, place the plants in a greenhouse near to the glass, in a night temperature of 65°. When they become injured to their position, pinch the heart out of them to encourage breaks. Shift them along as they require it. The compost from now on should be equal parts of peat and loam, with about a third of sand, and a little broken charcoal also may be added. See that the receptacles are well drained, as when the plants are growing they require plenty of water, which should have a free outlet to prevent stagnation. If peat cannot be procured, they will do very well in a good fibrous loam to which a third of leaf-mold has been added.—The first season the aim should be to procure a well-shaped plant and this may be done by cutting back the strong shoots, allowing the weaker ones to grow longer to acquire strength. Keep them protected from the sun with a slight shade, such as cheese-cloth, to prevent the foliage from burning. In winter a somewhat lower temperature may be given and a rather dry atmosphere maintained. When the plants are established in their flowering pots, applications of weak liquid manure may be given once a week until they show flower.—In the growing period, occasional syringings with clean water may be made to the under side of the foliage to prevent red-spider. Other insect pests may be kept in check by fumigation with hydrocyanic gas, at the rate of one-half ounce to the 1,000 cubic feet. The atmosphere and plants should be on the dry side, and the temperature around 60° when the operation is performed.—Some of the species flower in winter. *M. decemfidum* is an example. Others flower in summer, among which may be mentioned *M. corymbosum*, *M. denticulatum* (see *Miconia*), and *M. malabathricum*. (George F. Stewart.)

A. Lvs. strongly 5-nerved.

decemfidum, Roxbg. (*M. sanguineum*, D. Don. *M. malabathricum*, Sims, not Linn.). Three to 4 ft.: branches subterete and hirsute: lvs. lanceolate or

lance-oblong, long-acuminate, the nerves (or at least some of them) and the petioles often red; fls. 1-3, large, nearly or quite 2 in. across, the petals rose-colored and retuse. Java to China. B.M. 529; 2241.

normale, D. Don. About 5 ft., the hairy young branches brown-gray; lvs. petiolate, ovate-oblong, 5-nerved, yellow-felted beneath; fls. lilac-rose, several together at ends of bractless branches; calyx yellow-pubescent, the lobes linear-subulate; petals ovate, 1 in. long. India to Polynesia. R.H. 1910:332.

AA. Lvs. strongly 7-nerved or more.

cándidum, D. Don. Branches 4-angled, hoary, the younger ones pubescent, as also the petioles; lvs. ovate-acute, setulose above, villose beneath; fls. 3-7 in a cyme, rose-colored (sometimes white?), about the size of those of *M. decemfidum*; calyx-lobes shorter than the tube. S. China. *M. malabathricum*, B. R. 672(?).

malabáthricum, Linn. (*M. Banksii*, Cunn.). Differs from the last in having the calyx-lobes about equal to the tube, or sometimes even longer; lvs. oblong or ovate-oblong, acute or short-acuminate, sparsely setulose, above and beneath; fls. corymbose, purple, much smaller than in the last two. E. India to Austral.—Probably the *M. malabathricum* of horticulturists is one of the above species. Not known to be in the American trade.

corymbósum, Sims (properly *Amphiblénna cymósum*, Naudin. *Melastoma cymósum*, Schrad.). Branches terete, glabrous; lvs. large, petioled, the blade 5-6 in. long, cordate-ovate, short-acuminate, glabrous, 5-7-9-nerved, satiny green, sharply serrulate; fls.

in simple or branched scorpioid cymes; petals 5; stamens 10, very unequal; ovary 5-celled and hollowed at top; caps. turbinate, 5-valved at top, with minute seeds; lvs. membranaceous, long-petioled, ovate-acuminate, 5- or more-nerved, serrulate.

L. H. B.

MÈLIA (ancient Greek name). *Meliacea*. BEAD-TREE. Trees, from 30 to 40 feet high, some of them much planted South for shade and ornament; sometimes bushes.

Leaves deciduous, large, doubly pinnate or once-pinnate, the lfts. acuminate, glabrous; fls. in graceful panicles; sepals 5-6, imbricated; petals 5 or 6; stamens monadelphous, 10-12, of two lengths; ovary with several locules, topped with a single style; fr. a small indehiscent drupe.—Species few, of Asia and Austral.



2348. Umbrella tree—*Melia Azedarach* var. *umbraculiformis*.

A. Lvs. more than once-pinnate.

Azédarach, Linn. CHINA-TREE. CHINA-BERRY. PRIDE OF INDIA. Fig. 2347. Tree, to 40 ft. and more, making a thick trunk with furrowed bark; lvs. 2-compound, to 3 ft. long, stalked; lfts. many, ovate, oval or elliptic, acute, sharp-toothed or lobed; fls. purplish, in open panicles 4-6 in. long; petals oblongate or narrow-oblong, obtuse; sepals acute; ovary 5-celled; drupe nearly globular, yellow and smooth, $\frac{1}{2}$ - $\frac{3}{4}$ in. diam. Himalayan region, 2,000-3,000 ft. altitude, and probably native elsewhere in Asia; now widely planted. B.M. 1066. S.I.F. 2:35 (as *M. japonica*).—It has become naturalized throughout the S.; the northern limit of its hardiness is about Norfolk, Va., or somewhat southward, on the coastal plain area; it is luxuriant in N. C., except in the Piedmont country. The tree grows with great rapidity, and forms one of the most desirable shade trees, both from the bright green tint of the foliage, which is retained until late in the autumn, and also from the fragrance of the numerous lilac-colored fls. which are produced in April. These are succeeded by an abundant crop of berries, of a yellowish translucent color, which are readily eaten by cattle and birds. In some countries, the seeds are used for the making of rosaries. The wood, although coarse, is very durable. The tree can withstand a low temperature, but a cold of zero will injure or kill it. Several forms have been found, a white-flowering and one with the segms. of the lfts. cut in narrow divisions. These forms are not constant, the seedlings frequently reverting to the typical species. In all forms of *M. Azedarach*, the lvs. are 2- or 3-pinnate, the ultimate lfts. ovate or lanceolate, and varying from serrate to very nearly entire.

Var. *umbraculiformis*, Berekm. (var. *umbraculifera*, Hort.). TEXAS UMBRELLA TREE. Fig. 2348. Lfts. are less broad than in *M. Azedarach*, and the branches erect, and, in a manner, radiating from the trunk, the drooping foliage giving the tree the appearance of a gigantic umbrella. Mn. 8, p. 73. F.E. 26:187. G.F. 7:95.—The first tree that came to notice is said to have been found near the battlefield of San Jacinto, Texas, but with no record of its intro. there. If the fls. are not cross-pollinated with the common sort, the percentage of seedlings which reproduce the exact



2347. Leaf of *Melia Azedarach*. ($\times \frac{1}{2}$)

bright purple, in rather close terminal branching corymbs; petals oval, paler beneath; calyx-lobes ovate-triangular, ciliate; stamens 10. Upper Guinea. B.M. 904; 5473. L.B.C. 10:984.—To the genus *Amphiblénna*, Cogniaux admits 5 species. They are herbs or shrubs, of the *Sonerila* group or subfamily, with isomerous fls.; herbs or small shrubs of W. Trop. Afr., with fls.

umbrella shape seldom varies; hence it is supposed by some to be a distinct species.

sempervirens, Swartz (*M. Azedarach* var. *sempervirens*, Linn.). A low-growing tree with lvs. deeply incised, the lfts. the shape of those of *M. Azedarach*: fls. in axillary panicles, small, light lilac, fragrant, in constant succession. A greenhouse species, and a beautiful tree of distinct habit in S. Fla., where it is rapid-growing, holding its lvs. well into winter and blooming at intervals throughout the year. It is there prone to send up suckers and to prop. itself unduly from seeds. *M. sempervirens*, Swartz, is a widespread plant in the W. Indies and elsewhere. B.R. 643.

floribunda, Carr. (*M. Azedarach* var. *floribunda*, Morr. *M. japonica* var. *sempervirens*, Makino). By some considered to be a precocious and very floriferous form of *M. Azedarach*, but the plant grown in this country under this name and as *M. sempervirens* (and which is probably the same as Carrière's *M. floribunda*) is a bushy species, not tree-like, and should receive further study. In S. Fla. it is a "small awkward shrub, never reaching above 10 ft. and seldom branching." In S. Calif. it rarely reaches above 8 ft. and suckers continually; by cutting down to the ground the sts. that have bloomed, it can be had in flower nearly all the year. *M. floribunda* is said to begin to bloom at 1-2 ft., and to flower the second and third years from seed. The lfts. are lanceolate or oblong-lanceolate rather than ovate, very gradually taper-pointed. Perhaps Japanese. R.H. 1872:470. B.H. 30:176.

AA. Lvs. once-pinnate.

Azadirachta, Linn. (*Azadirachta indica*, A. Juss., and by some recent writers kept generically distinct). Large tree, sometimes 50 ft.: lvs. broad, pinnate, with 9-15 lance-acuminate, oblique, more or less serrate lfts.; fls. white, fragrant, very small, 5-merous; petals ciliate; drupe $\frac{1}{2}$ - $\frac{3}{4}$ in. long, oblong, the seeds yielding oil: foliage crowded near the ends of the branches. India.—Not hardy in the Cent. S.

M. japonica, Don, is by Hemsley (Fl. China) referred to *M. Azedarach*; *M. japonica*, Hassk., is by some referred to *M. Azadirachta*, but is perhaps distinct; apparently these plants are not in the trade.

L. H. B.†

MELIÁNTHUS (Greek, *honey-flower*). *Meliaceae*; formerly included in *Sapindaceae*. Evergreen shrubs of South Africa, to be grown out-of-doors in southern California and similar climates.

Leaves alternate, stipulate, odd-pinnate; lfts. unequal-sided; fls. in axillary and terminal racemes, secreting honey plentifully; calyx laterally compressed, with or without a sac-like protuberance at the base, with a nectar-bearing gland within; petals 5, the anterior one abortive; stamens 4, didynamous. *M. himalayanus*, Wall., is *M. major*, which has been intro. into S. Asia.—About a half-dozen species, strong-scented.

A. Lfts. entire.

pectinatus, Harv. (*M. Trimenianus*, Hook. f.). Rigid shrub, with densely set pectinate-pinnate lvs. on short twigs, the rachis winged: lfts. 8-10 pairs, linear, entire, with revolute margins, white-tomentose beneath: fls. dull red, in more or less whorled racemes, the peduncles purple; petals 4, long-clawed; upper calyx-segm. cuspidate. B.M. 6557. G.W. 4, p. 39.

AA. Lfts. toothed or serrate.

B. Calyx gibbous at base.

majör, Linn. St. flexuous, glabrous, sometimes 10 ft. or more in height, with a widely creeping root: lvs. gray, a foot or more long, the upper ones smaller; stipules grown together into one large intra-axillary piece, attached to the lower part of the petiole; lfts. 9-11, 3-4 in. long, 2 in. wide: racemes densely fld., 1 ft. or more in length; bracts ovate, acuminate: fls. red-brown, 1 in. long: caps. papery, 4-lobed at the apex, 1-1½ in. long; seeds 2 in each cell, black and shining. Cape. G.C. III.

36:142. B.R. 45. R.H. 1867, p. 131; 1913, p. 413. G.W. 4, p. 37.—An excellent foliage plant. *M. intermedius*, Hort., is a hybrid between this species and *M. comosus*.

BB. Calyx not conspicuously gibbous at base.

minor, Linn. Shrub with branchlets and infl. somewhat canescent: lvs. 5-6 in. long; stipules 2, subulate, lateral free; lfts. 1½-2 in. long, 6-10 lines wide: racemes 6-12 in. long, subterminal; fls. dull red: caps. obtuse at each end, scarcely 4-lobed, 8 lines long.

comosus, Vahl. Shrub with grayish white branches: lvs. 4-6 in. long; lfts. lanceolate, serrate, pubescent above but becoming glabrate, white-tomentose beneath: fls. orange inside, red-spotted outside and green at base, alternate in nodding racemes; petals oblong or spatulate: caps. oval, 4-winged. B.M. 301 (as *M. minor*).

M. B. COULSTON.

L. H. B.†

MÉLICA (old Italian name for Sorghum, from *mel*, honey). *Gramineæ*. MELIC GRASS. Slender-stemmed perennials: spikelets 2- to several-fld., rather large, often richly colored or with a pearly luster, in narrow or open panicles.—Species about 35, throughout temperate zones. Several beautiful native species of U. S., but not known in cult. *M. ciliata*, Linn., of Eu., with a pale spike-like panicle of silky spikelets is sometimes cult. for ornament, and *M. violacea*, Cav., a Chilean species with graceful panicles of violet-tinged broadly winged spikelets, has been recently intro.

A. S. HITCHCOCK.



2349. *Melicocca bijuga*. (Sprays $\times \frac{1}{4}$)

MELICÓCCA (Greek, *honey berry*, referring to the taste of the fruit). *Sapindaceæ*. Two species of tropical fruit trees, natives of America.

Leaves abruptly pinnate: racemes divided; calyx 4-parted; segms. imbricated; petals 4; stamens 8; disk complete; stigma peltate, sub-sessile; ovary 2-celled: berry 1-2-seeded.—S. Amer., perhaps native also in W. Indies.

bijuga, Linn. SPANISH LIME or GENIP. Fig. 2349. Lfts. in 2 pairs, elliptical or elliptic-lanceolate, entire,

glabrous; fls. whitish, in terminal racemes.—Cult. and naturalized in W. Indies and perhaps native there. The foliage is distinct, the compound lvs. with winged petioles resembling those of *Sapindus saponaria*, the W. Indian soap-berry. The Spanish line is cult. in S. Fla. and S. Calif. Its frs. are about the size and shape of plums, green or yellow, and have a pleasant grape-like flavor. The large seeds are sometimes roasted like chestnuts. The tree grows slowly, attaining 20–60 ft., and bears freely. It can be fruited in the N. under glass. It withstands several degrees of frost. This fruit is the mamoneillo of Cuba, where it is much prized. It is little known in the U. S. The fr. is usually about an inch long, with thin leathery and green skin and a rather seant acid refreshing pulp that adheres closely to the seeds; it is eaten out of hand, being torn open at one end to allow the translucent white and juicy contents to pass into the mouth. L. H. B.

MELILÔTUS (Greek for *honey lotus*). *Leguminosæ*. SWEET CLOVER. MELILOT. Perhaps twenty species of annual or biennial tall-growing sweet-smelling herbs, widely distributed in temperate and subtropical regions as weeds, some of them of value for forage and green manure.

Leaves pinnately 3-foliolate, the lfts. toothed and mostly narrow; fls. small, white or yellow, in slender, long-stalked, axillary racemes; calyx-teeth short and nearly equal; corolla papilionaceous, the standard oblong or oblong-obovate, keel obtuse; fr. a small, few-seeded, not twisted but more or less reticulated flattish indehiscent or tardily dehiscent pod.—The species are native in temperate and subtropical regions in the northern hemisphere. Two species, *M. officinalis*, Lam. (yellow-fl.), and *M. alba*, Desr. (white-fl.), have become weeds along roadsides and in waste places. *M. indica*, All., a common weed in Calif., has very small yellow fls. A recent species.

The prevailing sweet clover, the country over, is *M. alba*. It is an erect biennial herb, often higher than a man, flowering abundantly in spring and early summer. It is said to prefer soils rich in lime, and it thrives on poor and dry soils. Under the name of Bokhara clover and sweet clover, it is grown somewhat as a forage plant. Cattle come to like it for grazing, particularly if turned on it early in the season, before other herbage is attractive. It may also be cut for hay, particularly the second year. About twenty pounds of seed is required to the acre. It is an excellent bee-plant. L. H. B.

MELINIS (Greek, *meline*, millet). *Gramineæ*. A glutinous grass with branched decumbent stems, flat blades and terminal panicles of very small spikelets, of value as a forage plant in the tropics.

Spikelets 1 line long, with a perfect terminal floret and a sterile floret below; first glume very small; second glume and sterile lemma about as long as the spikelet, notched, the latter awned; perfect floret awnless.—Species one.

minutiflora, Beauv. (*Panicum Melinis*, Trin.). MOLASSES GRASS. Two to 4 ft., the base branched, decumbent, tangled and rooting; sheaths and blades viscid-pubescent; panicles purplish, 3–6 in. Brazil and S. Afr. Mart. Fl. Bras. 22:33.—A good forage grass. Has been tested in the W. Indies and in S. Fla.

A. S. HIRNCOCK.

MELIÓSMA (Greek *meli*, honey, and *osma*, odor; alluding to the fragrant flowers). *Sabiaceæ*. Trees or shrubs grown for their handsome foliage and the large panicles of white or whitish flowers.

Deciduous or evergreen trees or shrubs; lvs. alternate, without stipules, simple or odd-pinnate, with opposite lfts. serrate or entire; fls. in terminal or axillary panicles, perfect, rarely polygamous; sepals 5, rarely 4; petals 5, unequal, the outer 3 roundish, imbricate; the inner 2

much smaller, usually lanceolate, often bifid; stamens 5, usually connate with the petals, the outer 3 sterile; reduced to irregularly cup-shaped staminodes, the inner 2 fertile, the anthers surrounded at the base by the cup-shaped apex of the filaments; ovary superior, often surrounded by a disk, 2-celled, rarely 3-celled, each cell with 2 ovules; style simple; fr. a subglobose or oblong small drupe, usually 1-seeded.—About 50 species in E. and S. Asia and in Cent. and S. Amer.

The meliosmas in cultivation are handsome deciduous trees or shrubs with large pinnate or simple generally oblong leaves with numerous closely set lateral veins, with large often drooping panicles of small white or yellowish usually fragrant flowers followed by pea-sized black or red fruits. Except *M. myriantha*, they are of recent introduction and little is known of their hardiness and their cultural requirements, but they certainly possess promising ornamental qualities, the handsomest being apparently *M. Beaniana* and *M. Veitchiorum*. The latter and *M. cuneifolia* have proved hardy in southern England, and in this country they will probably be hardy as far north as New York or even New England, while the other species are tender. Propagation is by seeds sown as soon as they are ripe; also by layers and probably by cuttings of half-ripened wood under glass.

A. Lvs. simple.

myriantha, Sieb. & Zucc. Tree, to 30 ft.: lvs. obovate-elliptic to oblong or oblong-obovate, short-acuminate, broadly cuneate or sometimes rounded at the base, toothed, glabrous above, sparingly pubescent beneath, more densely so on the veins, without tufts of hairs in the axils of the veins, 4–8 in. long, with 24–30 pairs of veins; fls. greenish yellow, $\frac{1}{16}$ in. across, in upright panicles 6–8 in. long, with ascending branches; fr. red, $\frac{1}{4}$ in. across. July. Japan. S.I.F. 2:46. G.C. III. 31:30.

cuneifolia, Franch. Shrub or tree, to 20 ft.: lvs. obovate, acute or abruptly acuminate, narrowly cuneate at the base, sinuately toothed, glabrous above, pubescent on the veins beneath and with tufts of hairs in their axils, 3–7 in. long, with 20–25 pairs of veins; fls. yellowish white, $\frac{1}{4}$ in. across, in upright panicles with spreading branches, about 8 in. across; fr. black, $\frac{1}{4}$ in. across. July. W. China. B.M. 8357.

AA. Lvs. odd-pinnate.

Veitchiorum, Hemsl. Tree, to 50 ft.: young branchlets with brown shaggy hairs, soon glabrous, marked with conspicuous lenticles and the older ones with large li.-scars; lvs. 1–3 ft. long; lfts. 9–11, ovate to ovate-oblong or oblong, obtusish or short-acuminate, rounded or broadly cuneate at the base, entire, rarely remotely crenate-serrate, glabrous or nearly so, 3–7 in. long; panicles terminal and axillary, drooping, 8–15 in. long, with or after the lvs.; fls. yellow, $\frac{1}{16}$ in. across; fr. black, subglobose or pyriform, $\frac{1}{4}$ – $\frac{1}{3}$ in. across, sparingly produced. May; fr. in Sept. Cent. China.—A handsome tree with its large pinnate foliage and the long drooping panicles of very fragrant yellowish fls. A recent species.

Beaniana, Rehd. & Wilson. Tree, to 50 ft.: young branchlets brownish tomentose; lvs. 6–12 in. long; lfts. 5–13, ovate to elliptic-lanceolate, acuminate, cuneate or sometimes rounded at the base, remotely serrulate or nearly entire, glabrous above and nearly glabrous beneath except tufts of hairs in the axils of the veins, 2–6 in. long; panicles very numerous, before the lvs., 4–8 in. long; fls. creamy white, $\frac{1}{16}$ in. across; fr. globose, black, $\frac{1}{4}$ in. across. May; fr. in Sept. Cent. China.—A striking plant when covered in spring with a mass of creamy white fls.

M. Outhamii, Miq. Tree, to 60 ft.: lvs. odd-pinnate; lfts. 9–13, ovate to oblong, serrate, nearly glabrous, 2–4 in. long; fls. white, in broad panicles, 8–12 in. across. Cent. China to Korea.—*M. pendens*, Rehd. & Wilson. Allied to *M. myriantha*. Shrub, 8–15



LXIX. Muskmelon of the Hackensack type.

ft.: lvs. obovate-elliptic to obovate-oblong, sparingly pubescent beneath, particularly on the veins, 2-5 in. long, panicles slender, drooping, with spreading or reflexed branches; fls. white. Cent. China.

ALFRED REHDER.

MELÍSSA (Greek, *bee*; because the bees are fond of balm). *Labiata*. Hardy perennial herbs from Europe and western Asia, one of which is Balm (see Vol. I, p. 442).

Plants erect, leafy and branching, with broad opposite lvs.: fls. white or yellowish, in axillary clusters, somewhat secund; corolla exserted from the long-campanulate calyx, curved, enlarged above and naked within, 2-lipped, the upper lip erect and notched and the lower one spreading and 3-lobed; stamens 4, didynamous, ascending and approximate under the upper lip; style cleft at top: nutlets smooth.—Species 3 or 4, in Medit. region and Cent. Asia.

officinalis, Linn. **BALM**. Probably the only species cult., is one of the sweet herbs: pubescent odorous perennial, from S. Eu., N. Afr. and east, sometimes escaped from gardens in this country: lvs. ovate, crenate-dentate: fls. several in each cluster, nearly white or yellowish. Var. *variegata*, Hort., sometimes used for edgings.

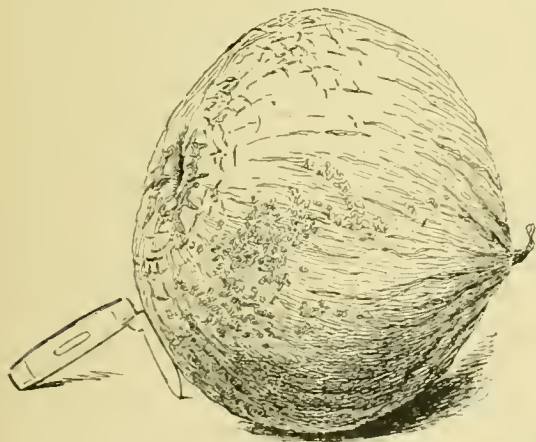
L. H. B.

MELÍTTIS (from Greek *melitta*, *melissa*, a bee). *Labiata*. One perennial herb in Cent. and S. Eu. and W. Asia, useful for hardy borders. Technically it differs from the long-fl. species of *Stachys* by its large usually 3-lobed calyx and axillary fls. *M. Melissophyllum*, Linn. (*M. grandiflora*, Smith), has nearly simple sts. 12-18 in. high, erect, slightly hairy: lvs. cordate-ovate, dentate: fls. large, 2-6 together in axillary whorls, shorter than the lvs., pink and variously variegated; corolla 1-2 in. long, the tube broad, the upper lip erect or reflexed, the lower lip spreading and 3-lobed; stamens 4, in pairs.

L. H. B.

MELOCÁCTUS: *Cactus*.

MELON. A name applied to two very different fruits of the Cucurbitaceæ. Unqualified, the word refers to fruits of the different botanical varieties of *Cucumis Melo* (which see, Vol. II, p. 907). The word muskmelon usually refers to the same fruits, although



2350. The Cassaba melon. ($\times \frac{1}{4}$)

some forms of *Cucumis Melo* are not musk-scented. The word watermelon refers to the fruits of *Citrullus vulgaris* (Vol. II, p. 780). Inasmuch as the cultural requirements for all melons are very much alike, the whole subject is considered here together.

The cultivated forms of *Cucumis Melo* are very many, and they are difficult of clear classification.

The musk-scented forms might be assembled into one group, including the nutmeg or netted melons and the cantaloupe or hard-rinded melons, although the name cantaloupe has become generic in this country for all musk-scented melons. The non-odorous, or at least relatively non-moschatous, melons might comprise another group; and to this would be referred the winter melons, *Cucumis Melo* var. *inodorus*. The winter melons, as a whole, have not been popular in North America, and are, in fact, not generally known. They require a long season in which to mature (see Cornell Bull. No. 96, pp. 364-366, 1895). Very likely the so-called winter or late-keeping melons may not all represent the botanical var. *inodorus*.—Some of the forms of the species are used in the making of preserves and condiments, or even grown for ornament, rather than for eating out of hand. Of such are the Chito (Fig. 2351) and Dudaim types, which are described on page 908.

To the winter melons probably belongs the Cassaba (Fig. 2350), which has lately become popular in California, whence it is shipped east late in the season. The name, variously spelled Kassaba, Cassaba, Casaba, Cassabah, Casba, is derived from the town Kassaba near Smyrna, Asia Minor, whence it was introduced. The seed has been more or less in commerce for many years. According to G. P. Rixford, the seed of the late Kassaba was sent from Smyrna to California late in 1878 by Dr. J. D. B. Stillman and James L. Flood, who found the melons in the hotels of that city. A crop was grown in California in 1879, and appeared on the markets that autumn in limited quantity. M. Rixford, then connected with the "Evening Bulletin," secured a good part of the stock and the next summer had a large quantity raised; and in the winter of 1880-81 seeds were distributed to 3,000 country subscribers of the "Bulletin." The melons did not then become popular, however, because they were usually marketed too green; for these melons must be thoroughly ripe to disclose their excellent flavor. In the original edition of "California Vegetables" (1897), Wickson describes the Cassaba or Pineapple melon as "fine, large, late variety, rich, cream-colored flesh; keeps well into winter."

Another Cassaba melon was sent out long before this by the Patent Office, before the organization of the Department of Agriculture. This received special attention from General Bidwell of Chico, California, and became known as the Bidwell Cassaba. This is a large summer melon, said to grow to 1 foot in diameter. This is said to be known only locally, although it was grown at Cornell twenty-five years ago.

On the introduction of Cassabas in this country, W. W. Tracy writes as follows: "The name Cassaba was used in this country as early as 1871, when Bridgman offered the 'Persian,' or 'Ordessa,' or 'Cassaba.' The 'Green Persian,' which seems to have been very much like that stock, if not identical with it, was offered by Ross, of Boston, in 1827. In 1872, Henry A. Dreer offered 'Cassaba' and published a good illustration of it; this seems to be very much like the Bay View of more recent years except that it is more pointed at the stem-end. None of these melons, as they are remembered, was like the Cassaba of California trade today, but were very much like the Cassaba as grown at Chico, California, under the name of Bidwell Cassaba. It seems that the term 'Cassaba' has been used indiscriminately for several different varieties of melons, some of them quite distinct from the others."

L. H. B.

Muskmelon.

The modern cultivated varieties of muskmelon are supposed to have been derived from the wild types native to Asia and Africa. There is some question as to whether the melon was known to the ancient Egypt-

tians as a cultivated plant. It was probably introduced into the Mediterranean countries of Europe about the beginning of the Christian era. Pliny refers to a "new form of cucumber. . . . called *melopepo*, which grows on the ground in a round form, and . . . although not suspended, yet the fruit separates from the stem at maturity." Nonnius, in the sixth century, speaks of "cucumbers" which are highly odorous. It seems probable that these authors refer to the musk-

fruted melons weigh anywhere from two to fifteen pounds each.

The flesh of the muskmelon may be either salmon-colored or greenish. The green-fleshed sorts are the more delicately flavored, while the salmon-fleshed varieties are likely to have a more pronounced musky flavor. Formerly, the green-fleshed sorts were preferred on most markets; but in the last few years the demand for salmon-fleshed sorts has been increasing rapidly.

The muskmelon thrives best in a fairly warm climate, but is not so partial to intense summer heat as is the watermelon. It can be grown wherever the summers are sufficiently long to enable it to develop and mature its crop between the frosts of spring and fall. From four to five months are required from the planting of the seed to the end of the harvest. It is considered an exacting crop, and is therefore often omitted from home gardens even in regions where it might readily be grown.

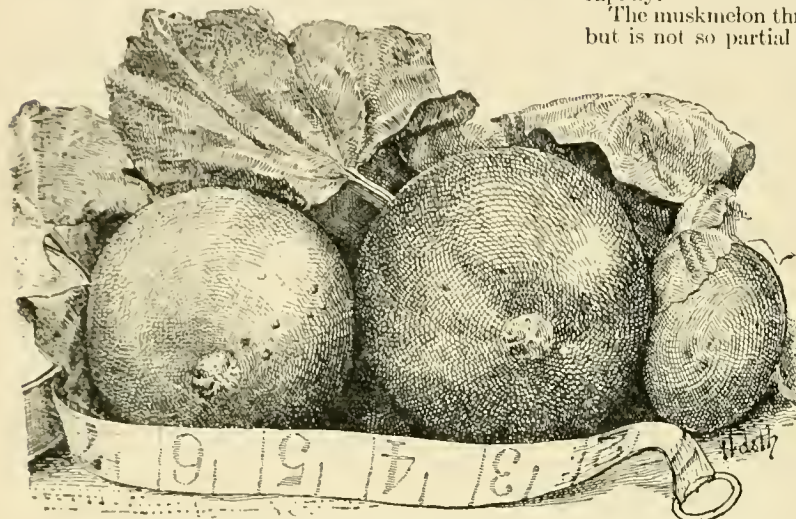
Development of the industry.

Up to 1870, muskmelons were grown principally in private gardens, and it was unusual to see them on the markets. A little later, however, the growing of muskmelons for the New York and other eastern markets was started in Maryland, Delaware, and New Jersey.

These melons were principally the Hackensack and Anne Arundel varieties (large-fruited), and the Jenny Lind, a small oblate melon. These melons supplied the market principally from the middle of July till the middle of August. Shipments increased from year to year until in the nineties the New York market sometimes handled from two to three carloads a day at the height of the season.

In 1881 the Netted Gem melon, a small, oval, heavily netted green-fleshed fruit, was first introduced to the public. This variety was destined to revolutionize the melon industry of America. It was tested for a few years, and in 1885 was grown for market in a small way by Wm. S. Ross at Alma, Illinois, and by J. W. Eastwood at Rocky Ford, Colorado. Each planted about one-half acre that year. So far as known, these plantings marked the real beginning of the melon industry in Illinois and in Colorado. Having more melons than his local market could consume, Ross shipped two barrels to Chicago in August, 1885. These were the first melons of this type ever seen on the Chicago market, and were the occasion of considerable amusement on South Water Street when the barrels were opened; the melons seemed ridiculously small as compared with the Hackensack and other melons then on the market. However, after the flavor had been tested, the melons were readily sold and an order received for all that could be furnished. The next year, Ross planted 20 acres, and a few years later, 90 acres. Soon a number of his neighbors began planting, and the industry grew at Alma, until the shipments reached ten to fifteen carloads a day. In 1900, from Alma alone 253 carloads were shipped. In the meantime the industry had spread to other Illinois points, including Anna and Balem in the extreme southern part of the state. Most of the Illinois melons were shipped in one-third-bushel Climax baskets.

Meanwhile the industry had been developing at Rocky Ford, Colorado, though up to 1894 the shipments had been made entirely by local express, and to



2351. The Orange or Chito melon.—*Cucumis Melo* var. *Chito*. Used in preserving.

melon. By the sixteenth century, many varieties of muskmelon were known to European writers.

The melon reached America among the earliest importations of plants from the Old World, for in 1494 it was recorded as grown by the companions of Columbus. In 1535, "musk melons" were mentioned by a traveler on the St. Lawrence. Melons were reported in New Mexico in 1540, and were abundant in Hayti in 1565. In 1584 they were found in Virginia by Captains Amidos and Barlow. In 1609 they were seen on the Hudson River, and were described as abundant in New England in 1629. In 1806, thirteen kinds were mentioned by M'Mahon as being under culture in America. At the present time, over 400 different variety names are given in American seed catalogues, although the number of important varieties is very much less.

There are two principal classes of muskmelons, the soft-rinded or netted melons, often called nutmeg melons (Fig. 2352), and the hard-rinded or warty melons, known technically as rock melons or cantaloupes. The latter class is grown principally in Europe, often under glass, and is little known in America. The term cantaloupe as used in America is primarily a trade name employed to designate nutmeg melons in general, or, more often, the small type of melon that is shipped in baskets or crates.

The class of muskmelons commonly grown in America may be arbitrarily divided into two groups: large-fruited and small-fruited. This classification is important from a marketing standpoint, since the large-fruited melons are grown principally by market-gardeners, and hauled in bulk to their respective markets, where they are sold by count, though sometimes they are grown as a truck crop and packed in crates to be shipped to the general market. The small-fruited melons are usually packed in crates or baskets, and are very much more extensively handled on the general market than the large-fruited type. The typical small-fruited or "crate" melons weigh about one and one-fourth to one and one-half pounds each; the large-

Colorado markets only. That year some of the growers joined together and loaded ventilator cars which were shipped by freight. Up to this time the melons had been shipped in boxes, barrels, and home-made crates,—principally crates made from 12-inch boards and common laths sawed in two. In 1896 the growers were supplied for the first time with regular crates made at a lumber mill. These crates were 12 by 12 by 22½ inches, inside measure,—practically the same as the home-made crates,—and have ever since been the standard package for Rocky Ford melons. In this year a few cars of melons were shipped as far east as Kansas City and St. Louis.

The Rocky Ford Melon Growers' Association was organized in the fall of 1896 for the purpose of coöperative marketing of Rocky Ford melons; and in 1897, 121 carloads were handled in eastern markets, including Pittsburgh and New York. The melons met with favor and sold at good prices. The next year the membership of the Melon Growers' Association was increased to over 800, and more than 5,000 acres of melons were planted. The yield was heavy, and the markets became glutted with unsalable melons, due partly to poor refrigeration. The outlook was discouraging, and many farmers turned their attention to sugar-beets the next year. However, the melon industry continued, and from 1897 to 1905 inclusive, 5,999 carloads were shipped from the Rocky Ford district, the largest number being in 1904, when 1,182 cars were shipped. Refrigeration was improved, so that the melons carried safely even to Boston, a run of 150 hours.

The success of the Rocky Ford melons on the various markets stimulated the planting of melons of the same type in many other parts of the country, especially in the southern states, and Rocky Ford was looked to as the source of seed. Today the production of melon seed, as well as market melons, is an important industry at Rocky Ford. A number of distinct strains of the Netted Gem type of melon have been developed at Rocky Ford, and the seed is sold under various names, such as Watters' Solid Net, Eden Gem, Netted Rock, Rust-Resistant Rocky Ford, and so on.

The growth of the melon industry of the United States from 1897 to 1905 is indicated by the fact that in 1897 only about 400 carloads of muskmelons were marketed, while in 1905 the shipments amounted to 6,920 carloads.

In 1905, the Imperial Valley of southern California sprang into prominence as a melon-producing region. This valley lies mostly below sea-level, and is situated where the climate is extremely hot. Until 1900 it was known only as a desert. That year work was commenced on a canal system for conducting irrigation water to the valley from the Colorado River, a distance of about 60 miles. In 1905, expert growers from Rocky Ford were secured to organize the melon industry and supervise the growing and packing of the product. One thousand acres were planted that year, and 297 carloads of melons were marketed. Production has increased from year to year, until the Imperial Valley has far outstripped Rocky Ford in the production of melons, and is now recognized as the foremost melon-producing region in the world. The shipments from the Imperial Valley for each year from 1905 to 1914 inclusive were as follows:

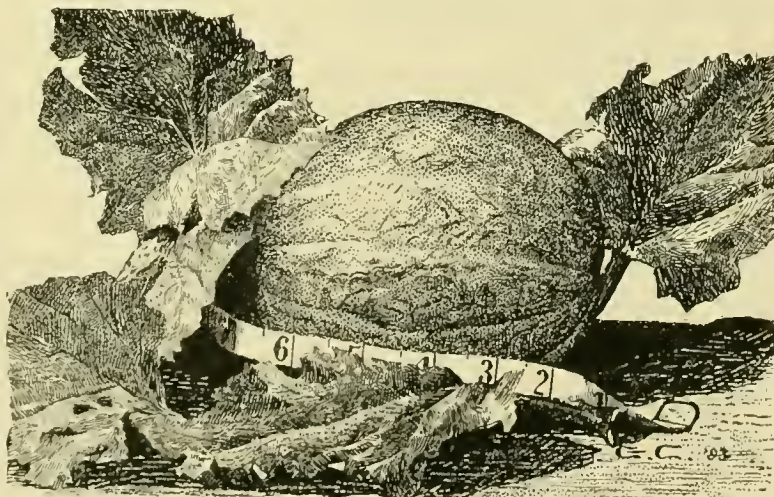
Year	Carloads	Year	Carloads
1905	297	1910	1,630
1906	577	1911	2,551
1907	644	1912	2,750
1908	1,911	1913	3,502
1909	1,411	1914	4,446

The hot climate of the Imperial Valley makes early planting possible, and carlot shipments usually begin in May, and continue through June and often a large part of July. These melons, due to pre-cooling and otherwise perfect refrigeration, are shipped safely even to the Atlantic seaboard; and thus all the large markets are fully supplied with melons of uniform grade and quality from four to six weeks earlier than was formerly the case.

Beginning with the California product in May, the markets of the United States are supplied with melons of the Netted Gem or Rocky Ford type continuously until late in October. The states producing these melons in sufficiently large quantities to be mentioned in the general market reports in 1914 were as follows, the states being named in approximately the order in which their products first appeared upon the markets: California, Texas, Florida, Georgia, Illinois, Arizona, Arkansas, Oklahoma, South Carolina, North Carolina, Indiana, Nevada, Maryland, Delaware, Utah, New Mexico, Colorado, Tennessee, Michigan.

Cultivation of the muskmelon.

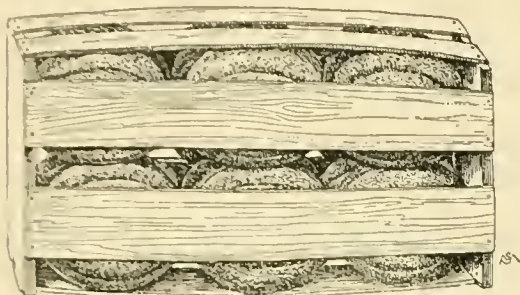
Statements that muskmelons demand a particular type of soil are misleading, for the muskmelon can be grown successfully on almost any kind of land from light sandy loam to heavy clay loam, provided the land is properly drained, adequately fertilized, and thoroughly cultivated. Natural drainage is considered best, and melons are usually planted on slopes and knolls rather than on low or flat lands. The soil should be well supplied with humus, either as a result of plowing under a sod or catch-crop or an application of manure. Unless the soil is naturally rich, special fertilizer treatment should be given to the particular spot where each melon hill is to stand. In the home garden, holes are sometimes dug with a spade and partially filled with rotted manure, which is then covered with soil, in which the seed is to be planted. In field culture, the land is furrowed out both ways with a plow, and from a quart to a half-peck of fine, rotted manure or compost is placed at each intersection. The manure is then covered with fine moist soil, and from ten to twelve seeds are planted in each hill. In humid climates, the



2352. A nutmeg melon.

seed is covered about $1\frac{1}{2}$ inch deep; in irrigated regions it is covered about $1\frac{1}{2}$ inches.

Attempts to substitute commercial fertilizer for manure in enriching muskmelon hills have usually resulted unsatisfactorily; and attempts to grow melons without special treatment of the individual hills have resulted in failure except on land already very rich, such as market-garden soil or alfalfa sod plowed under.



2353. Crate- or box- packing of melons.

Since muskmelons demand a relatively high temperature and are easily injured by frost, it is useless to plant the seed in the open ground until the weather has become warm and settled. Planting in Colorado, Illinois, Indiana, and similar latitudes usually takes place from May 10 to 20. Attempts to increase the earliness of melons by protection of the plants in the field by means of hand-boxes or forcing-hills are applicable only to amateur areas. Starting the plants in hot-beds and transplanting them to the field when about four weeks old is more practicable on a commercial scale. Since a melon plant is likely to die if the root system is disturbed in transplanting, the seeds must be sown in pots or dirt-bands, or on inverted sods, and the plants very carefully handled during transplanting.

Muskmelon hills are placed from 4 to 6 feet apart, and the plants are thinned to two or three in each hill. Tillage is begun as soon as the plants are visible, and is repeated at frequent intervals until the vines cover the ground, or until the crop is harvested. In the latter case, the vines are kept in windrows, thus allowing space for the pickers as well as permitting late tillage.

In irrigated regions and in rich garden soil, muskmelons are often planted in drills instead of hills. The rows are made 6 or 7 feet apart, and the plants thinned to 2 feet apart in the row. If the crop is to be irrigated, the seed is sown close to the irrigation furrows, and the water turned in immediately after planting, to insure germination. Irrigation is repeated according to the demands of the crop, until the melons are well developed; then the water is withheld to a large extent, and little if any irrigation is given during the picking season. Comparative dryness of the soil when the melons ripen favors the development of high quality in the fruits.

In addition to tillage (and irrigation, in an arid climate), the care of muskmelons consists principally in protecting them from their enemies. Striped cucumber beetles are likely to attack the plants as soon as they appear above ground. They may be controlled by the application of a repellent, such as turpentine mixed with land plaster and dusted on the plants, or bordeaux mixture applied as a spray. The melon louse or aphid is often a serious enemy, especially in dry seasons. It is readily controlled by spraying with nicotine sulfate, if precaution is taken to reach the undersides of the leaves with the spray. The leaf-spot or "rust" is a fungous disease that attacks the foliage of muskmelons, and in some localities has interfered seriously with the production of a marketable crop. In the case of a severe attack it so weakens the vines

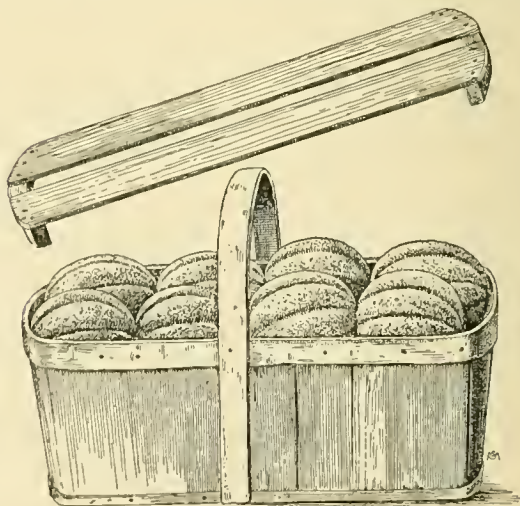
that the melons do not develop properly and are of poor flavor. This disease has been controlled successfully by repeated spraying with bordeaux mixture, the turning of the vines into windrows making late spraying possible. Also, rust-resistant strains of melons have been developed; so that the disease is no longer a serious menace to the melon industry.

Harvesting and marketing.

Muskmelons must be picked while still firm in order to reach the market in an acceptable condition, yet if they are removed from the vines too early they lack flavor. Unless the market is too distant, melons of the Netted Gem type should not be picked until they will part readily from the stem, and the color of the skin changes slightly from green to gray as seen through the netting. To get the melons picked uniformly at this stage, it is necessary to go over the plantation every day, and in hot weather twice a day.

In order that melons may be kept as cool as possible after they are picked, they are taken immediately to the shade of a packing-shed, where they are graded and packed in crates or baskets. The standard crate for Colorado melons (already mentioned) has been adopted in several other states. It contains forty-five standard-size melons, or twenty-seven to thirty-six "Jumbo" melons. "Pony" crates are slightly smaller (11 by 11 by $22\frac{1}{4}$ inches), and are packed with fifty-four smaller melons. The melons in the standard crate are arranged in three tiers of fifteen melons each, and each tier is three melons wide and five melons long. Since the crate is made of slats, forty-two of the forty-five melons can be seen from the outside. This permits thorough inspection of the contents of every crate, both at the shipping-point and on the market. Rigid inspection before shipment has helped materially in establishing the reputation of Rocky Ford melons on the markets. California melons and some of the Colorado melons are wrapped in tissue paper to insure better keeping in long-distance shipments. When so handled, the packing is more rigidly supervised, and less dependence is placed on inspection at the loading-platform.

If melons are to be more than twenty-four hours en route, they are usually shipped under refrigeration. The crates are loaded three tiers high, and ample space is left for circulation of cold air. A minimum earload consists of 364 crates, averaging sixty-six pounds each, and the melons seem to reach market in better condition if the cars are not more heavily loaded.



2354. Basket- packing of melons.

The handling of muskmelons or "cantaloupes" in earlead lots is an important branch of the produce business, and certain firms known as "general distributors" make a specialty of this product.

Montreal muskmelons; frames.

In addition to the small-fruited "crate" or "basket" melons that are shipped by the earload across the continent, and the ordinary varieties of large-fruited melons that are very generally grown by market-gardeners in outdoor culture, there is a large-fruited variety known as the Montreal Market, which is grown principally near Montreal, Canada, by special methods, and commands very high prices in some of the eastern markets. The seed is sown in greenhouses or hotbeds, usually in pots, early in March, and the plants are later set in sash-covered frames, which afford protection until the crop is nearly grown. Before the frames are placed, the soil is thrown up in ridges about 12 feet wide, and a trench 2 feet wide and 15 to 18 inches deep is dug along the center of the ridge. This trench is filled nearly level with fermenting manure, and then covered with fine moist soil. When the soil over the manure has attained the right temperature, the plants are set. Usually one hill (two plants) of melons are grown under each sash; so that a 6 by 12 frame will accommodate four hills if 3- by 6-foot sash are employed. Great attention is given to watering, syringing, and ventilation. As the fruits develop, they are kept from contact with the soil by means of shingles, pieces of board, flat stones, or slate. Each fruit is turned every few days to insure uniformity in ripening and in development of netting. When the area within the frames becomes fully occupied by vines, the frame is raised a few inches above the ground so that the growing tips of the vines may push out. More ventilation is given as the season advances, and finally the sash and even the frames are removed entirely. The melons thus finish their ripening under outdoor conditions.

Montreal melons are shipped in large wicker baskets, holding one dozen melons each. The melons are packed in fine hay, and the baskets are shipped without covers.

Cassaba melons.

The melons commonly grown in the United States are perishable after reaching maturity, and their market season ends in October. Certain types of muskmelons known as winter melons will keep for several weeks after being picked, if they are properly handled. Melons of this type were formerly little known in America, but are now grown commercially in the San Fernando Valley in southern California, and are shipped by the earload to the larger eastern markets, principally during November and December. The seed was brought from the Mediterranean countries over thirty years ago, and tried in California. The first attempts at growing these melons were not commercially successful, but a few districts were found to be especially adapted to their culture. In the valley above mentioned, hundreds of acres are planted every year. These melons are large, firm, smooth-skinned, and very thick-fleshed. On the market, they are known as Cassaba melons. They are packed in excelsior in half-cases holding six melons, or in full cases holding twelve melons.

Literature.

Books: "How to Grow Melons for Market," W. Atlee Burpee; "Melon Culture," James Troop; "Cantaloupe Culture," P. K. Blinn. *Experiment Station bulletins:* Arkansas, No. 69; Colorado, Nos. 62, 85, 95, 104, 108, 121, 126; Georgia, No. 57; Illinois, Nos. 124, 155, 174; Indiana, Nos. 123, 135; New Hampshire, Nos. 52, 70, 172; also N. H. Technical Bull. No. 2 (classification, by F. Wm. Rane); New Mexico, No. 63; New York

(Cornell), Nos. 96, 200, 231; Rhode Island, No. 68; Vermont, No. 169.

JOHN W. LLOYD.

Watermelon.

The watermelon, *Citrullus vulgaris* (Figs. 2355, 2356), is a native of Africa, and is normally a dry-country plant. David Livingstone, writing in 1857, describes it as being very abundant in favorable years in the Kalahari Desert. He says that the species is very variable, some fruits being bitter and some sweet. All the animals of the region from elephants to mice, including the carnivora, seem to enjoy the fruits.

The watermelon was early taken to India, since it has a Sanskrit name. It reached China about the tenth century A. D. It has no name in the ancient Greek and Latin languages, and was probably not known to these people much before the Christian Era.

There are three fairly well-marked types of the cultivated watermelon: the round preserving "citron" (Fig. 2355), the stock (live-stock) melon, and the ordinary



2355. The preserving watermelon, commonly known as "citron."

watermelon. The two former groups are usually more hardy, more disease-resistant, stronger growers, and more productive. It seems probable that the forms of melon found on our southwestern prairies, and in the cotton fields of the South have returned to approximately their original wild condition. There is apparently little data on the original introduction of the watermelon into the United States. Judging from the varieties at present extant, it does not seem likely that it reached us from Mediterranean lands.

Commercial importance.

The watermelon is the most valuable vine crop grown in the United States. As a garden plant it has a wide distribution, but as a commercial product its culture is confined chiefly to the region to which the long-leaf pine is indigenous. This region includes the states bordering the Atlantic from Virginia southward as well as those bordering the gulf. The only states outside this territory which grow watermelons on a commercial scale are New Jersey, Indiana, Illinois, Oklahoma, Kansas, and California. The six states producing the bulk of the commercial crop in the order of their importance are Texas, Georgia, Florida, Indiana, Mississippi, and California.

The value of the commercial crop of watermelons in the United States, as stated by the census of 1910, was nearly \$4,500,000, grown on 137,000 acres.

In comparison with other vegetable crops, the watermelon stands seventh. The crops having a greater value are Irish potatoes, sweet potatoes, tomatoes, cabbage, onions, and sweet corn, in the order named.

Cultivation.

The watermelon thrives best on light, warm, sandy soils well supplied with organic matter. The plants

require a liberal moisture supply during their early life, but are able to produce abundantly in regions with relatively spare rainfall. In order to develop superior quality, the temperature during the fruit-bearing period should be high.

The preparatory treatment of the soil for watermelons preferred by most growers is to turn under a crop of cowpeas the previous autumn. An area which has not been under cultivation for several seasons and upon which there is a good stand of broom-sedge or grass is the second choice. While watermelon seed does not require to be planted early, the land should be prepared in time to allow weed seeds to germinate so that at least the early weed crop can be destroyed by harrowing before the melon seed is planted. This is important as the crop can be given thorough culture only previous to the vining of the plants. The object should be to do most of the cultivation before the crop is planted.

The watermelon, like all other vine plants, is a gross feeder and requires an abundant supply of available plant-food over a comparatively short growing season. For this reason, the fertilizing should be liberal and the materials used of a nature to be quickly available. When stable manure can be secured, this is to be preferred, but when it is not to be had crops planted on lands which have had a crop of cowpeas turned under respond reasonably well when a fertilizer carrying 3 to 4 per cent of nitrogen in the form of nitrate or sulfate of ammonia, 8 per cent of potash, either sulfate or muriate, and 8 per cent of phosphoric acid, either superphosphate or high-grade acid phosphate, is used at the rate of 400 to 500 pounds to the acre in the drill.

There is no advantage to be gained from planting the seed for the commercial crop of watermelons before the soil is in thorough tilth and well warmed up. Planting should be delayed until both the soil and the season are warm enough to insure quick germination of the seed and rapid growth of the plants. As a rule, the period for planting watermelons follows within a fortnight that for corn.

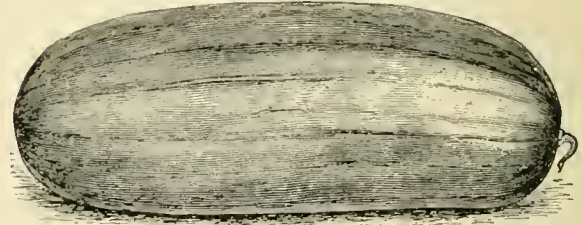
The watermelon is a more robust plant than either the cucumber or the muskmelon and requires more liberal spaces between both rows and hills in the row. Two general systems of planting are followed: planting in rows and planting in hills. Row-planting is very generally practised in some localities; the method followed is to open a furrow in which the fertilizer or manure is scattered and incorporated with the soil by the use of a suitable implement such as a scooter or sweep. Two furrows are then turned together over the fertilizer to form the bed on which to plant the seed. In humid sections this is somewhat above the general level of the surface, but in dry regions the seed is either planted on the level or slightly below. An abundance of seed is used so as to insure a dense stand of plants in order to fortify the plantation against the ravages of insect pests. After the plants are well established and the danger of loss of stand from insect depredations is over, the rows are thinned so that individual plants stand at intervals of 2 or 3 feet, or they may be thinned so that groups of three or four plants are as far as 6 or 8 feet apart. The rows are usually 8 feet apart. In the hill system of planting, the fertilizer is put either down the length of the row as above described, or the land may be laid off in check-rows 8 by 8 feet apart and a shovelful of well-rotted stable compost placed under each hill located at the intersection of the 8-foot marks. Fertilizer may be used instead of the manure. A stand of plants is insured by placing a dozen or more seeds in a hill, the seeds being scattered over an area of about 1 square foot and the seeds covered with not more than 1 inch of earth.

As has been observed, the main cultivation of the watermelon crop should be made before the seed is

planted. No opportunity, however, should be lost to keep the land free from weeds and in a fine state of tilth from the time the plants appear above ground until the vines are too large to continue the use of horse-power implements. Even after implements are excluded, all large weeds should be pulled by hand. In many sections of the South, it is a common practice to sow a light seeding of cowpeas in the watermelon fields at the time of the last cultivation to act as a partial shade to the fruits and to prevent the whipping of the vines in the wind. The cowpeas also contribute to the upkeep of the land, an important factor with the light soils used for melon-culture.

Melons should not follow closely after melons on the same land, as areas used too frequently for melon-culture are almost certain to become contaminated with the wilt disease fungus. As this fungus is capable of perpetuating itself for considerable periods when once the soil is infested, a rotation period of five to seven years is desirable in order to avoid losses on lands which have been previously used for the crop.

As has been suggested, the watermelon is not immune to the ravages of insect pests and fungous diseases. The striped cucumber beetle is one of the most annoying and destructive insect pests attacking this



2356. A market watermelon.

crop. In the garden it can be controlled most satisfactorily by the use of screens or by a square of mosquito netting dropped over a tiny stake in the center of the hill in such a manner as to form a tent over the young plant; then by drawing earth over the edges of the netting it will be held in place and the insects excluded. The use of tobacco dust or tobacco fertilizer as a mulch for the young plants serves as a fairly effective repellent and is at the same time a valuable fertilizer.

The wilt disease has caused great loss in years past and while no effective remedy is known, satisfactory crops can be secured by careful attention to crop-rotation in which wilt-resistant crops form a large factor and in which the interval between melon crops is sufficiently long, five to seven years being none too much.

Harvesting and marketing.

An important consideration in harvesting melons for earload shipment is to avoid mixing sizes in the ear. If two sizes are to be shipped in the same ear, they should be loaded in separate ends. Buyers establish the price for a load of melons by the minimum size of the melons in the load. Melon markets have strong likes and dislikes. Some prefer melons of a definite size only, others prefer melons with particular markings, while still others require either a long or globular melon. These peculiarities of the market should be carefully studied and the plantings be so planned as to meet the preferences of the market to the fullest possible extent. At shipping-time these features should be kept in mind and the distribution of the melons made accordingly.

Varieties of watermelon.

Melons of the highest quality have brittle flesh, few fibers, and a thin rind. Such melons are not well

adapted for shipment but are ideal for home use. The commercial melon is one that has good shipping quality, a firm not too thin rind, of a variety in which the melons run uniform in size, and of a weight ranging from twenty to thirty pounds. The variety must also be productive, of fair quality, and medium early. A few sorts worthy of a place in the garden for home use are Melver, Florida Favorite, Kleckley Sweets, Bradford, Long White Icing, and Sugar Loaf. Those most popular as shipping melons are Kolb Gem, Duke Jones, Pride of Georgia, or Jones, Mammoth Ironclad, and Dixie.

Seed-production.

The production of seed has been largely confined to the new prairie breakings of western Kansas and Oklahoma, where a crop can be grown very cheaply. It is interesting to note that the wild animals, notably coyotes, often destroy a planting, so that few fruits are left for seed. The melons grown for seed are pulped in machines devised for the purpose. These machines separate the rind and pulp from the seeds and juice. The mass of seeds and juice is allowed to ferment for one or a few days, when the seed is washed and spread on wire screens for drying. When the seed is thoroughly dry it should be run through a fanning-mill to drive off melon fragments and light seed, when it is ready for market. A crop of seed is rarely planted by a farmer without a contract with a seedsman, who agrees to take all or part of the crop at a stipulated price.

In practically all sections of the United States where field corn can be successfully grown, the watermelon can be depended upon to mature a crop sufficient to justify including it in the home-garden. While it can be grown on a wide variety of soils by giving them special preparation, it nevertheless grows best on rich sandy, or loamy soils. The prairie soils of the corn-belt as well as the glacial-drift soils of New York can be successfully used for the garden culture of the crop.

The watermelon is tender to frost, and as it makes its most rapid growth during the warm season, it should not be planted in cold soil or before the danger of frosts has passed. A safe rule for most sections is to plant ten days to two weeks later than corn.

The few hills of watermelons necessary to supply the needs of the average family should be prepared with special care. The seed-bed should be deep and the hills fertilized with manure or compost which will tend to accelerate the growth of the plants. No better use of hog- or chicken-manure can be made than in the preparation of a compost for watermelons. The hills should be given ample distance—7 or 8 feet each way—and the seeds should be scattered ten or twelve over an area about 1 foot square, and covered with about 1 inch of soil.

The young plants will require protection from insects; the use of mosquito-netting, before noted, will prove as inexpensive and as effective as any method yet devised.

After all danger of losing the stand of plants, either by frost or pests, has passed, the population of each hill should be reduced to three or four of the most vigorous plants. From this period on, care to prevent weed-growth should give satisfactory results providing a sort adapted to the region and to home use has been chosen.

L. C. CORBETT.

MELON, Papaw: *Carica Papaya*. **M. Shrub**: *Solanum muricatum*. Chinese Preserving M.: *Benincasa*.

MELOTHRIA (probably a name for a bryony-like plant; *melon* is Greek for apple, which may refer to the shape of the fruit). *Cucurbitaceæ*. Slender herbaceous vines, climbing or trailing, annual or perennial, with small yellow or white flowers and sometimes attractive little fruits, found in warmer parts of the world.

Plants with simple tendrils at the axils and very

small monoecious, dioecious or polygamous fls., the sterile usually in corymbs or racemes, the fertile solitary and often slender-stalked; lvs. entire, lobed or divided; fls. white or yellow; sepals 5; corolla 5-lobed, campanulate; stamens in sterile fls. 3 or 5, more or less connate by the anthers, in the fertile fls. reduced to rudiments; fr. a small pulpy pendulous berry, with usually many flat horizontal seeds.—Species perhaps 70, widely distributed, a few of them native from Pa. and Fla. to Texas.

Four kinds appear to be in the trade, *M. scabra*, *M. japonica*, *M. maderaspatana* and *M. punctata*, the last being perhaps the genus. These are slender but rapid-growing half-hardy annual climbers, which may be grown indoors in winter, but preferably outdoors in summer for covering unsightly objects. They are attractive in fruit.

Cogniaux (in DC. Mon. Phan., Vol. 3, 1881) makes three sections of the genus. *M. scabra*, *M. pendula*, and *M. japonica*, belong to the first, *M. punctata* to the second, and *M. maderaspatana* to the third. *M. punctata* has sensitive tendrils.

Section I. EUMELOTHRIA. Fls. usually monoecious, males mostly racemose and females solitary; anthers subsessile; fr. mostly with long and slender peduncles; seeds usually not margined and smooth.

Section II. SOLENA. Fls. mostly dioecious, males corymbose; anthers borne on rather long filaments, the connective not produced; fr. mostly short-peduncled; seeds mostly margined and smooth.

Section III. MUKIA. Fls. monoecious, males clustered and females solitary; anthers subsessile, the connective apiculate; fr. subsessile; seeds margined, usually pitted.

scabra, Naudin. Sts. more or less hairy; lvs. rigid, ovate-oblong or somewhat triangular-hastate, acute or short-acuminate, scabrous; tendrils filiform, short; fls. small, the masculine racemes 5-7-fl'd. and equaling the petiole; anthers roundish, with a wide connective, the cells straight, not plicate; fr. ovoid or ovoid-oblong, obtuse, 3-celled, rather large (1 in. long, ½ in. thick), with broad parallel stripes of white and green. Mex. R.H. 1901, p. 43.

pendula, Linn. Creeping or scandent, much-branched root-perennial, the st. glabrous and shining; lvs. suborbicular-cordate, acute or obtuse, hirsute becoming scabrous, often deeply 5-lobed, the lobes obtuse; male racemes 3-7-fl'd., usually shorter than the petioles; corolla yellow, the segms. obovate; fr. ellipsoid, to ½ in. long, the seeds obovate and whitish. Pa. to Fla. and La. and Mex.—*M. pendula*, *M. scabra* and *M. punctata* may be confused in horticultural literature.

japonica, Maxim. Lvs. ovate-triangular, emarginate at base, scabrous above, nearly smooth beneath, entire or shallowly 3-lobed; male fls. solitary; anthers suborbicular, not appendaged at apex; fr. ovoid-subglobose, the seeds usually marginless. Japan.

punctata, Cogn. (*Bryonia punctata*, Thunb. *Zehneria scabra*, Sond. *Pilogyne suavis*, Schrad.). Sts. glabrous at maturity, angled; lvs. membranous, cordate, angled or slightly 3-5-lobed, white-spotted and somewhat scabrous above, pilose, short-hairy or scabrous below, margin remotely denticulate; fr. brown, lightly pitted, about 3 lines thick; seeds small, about 2 lines long, strongly compressed. S. Afr. R.H. 1900, p. 661.—Intro. 1890 by Henderson & Co. as the oak-leaved climber. *Melothria punctata* is a beautiful climbing herbaceous perennial, better known as *Pilogyne suavis*, and sometimes called *Zehneria suavis*. Even when protected, it is too tender to stand the northern winters. It blooms in clusters; fls. small, white and star-shaped, with a strong musk fragrance; lvs. green, small and glossy. Being a very rapid grower, it is desirable for covering verandas or for house cult. It

will do well in any part of a living-room where it has light. It will grow as much as 16 ft. high in one summer by having a liberal supply of water every day and liquid manure once a week. After growing outdoors it can be cut down to 6 in., potted and taken into the house for the winter. In the spring it can be cut back, again planted out and it will do well. The roots may almost be called tuberous, and can be kept dormant in winter, the same as dahlias, buried in sand in a cool, dry place, free from frost. Increased by cuttings. (James Vick.)

maderaspatana, Cogn. (*Cucumis maderaspatanus*, Linn. *Bryonia scabrilla*, Linn. f. *Mükia scabrilla*, Arn.). Annual: lvs. ovate or somewhat deltoid, entire, angled or 3-5-lobed, very scabrous above and scabrous or short-hairy beneath; male fls. fascicled, the female solitary or only partially fascicled; fr. small, globose, smooth or sparsely echinulate, at first green and longitudinally variegated with brown-yellow, becoming red; seeds pitted. Trop. Asia and Afr.

M. fluminensis, Gardn., produces a fr. said to be pickled when green, in Porto Rico, and eaten, and also good when fully ripe: a climber 5 or 6 ft. long; lvs. cordate-ovate, usually acute or short-acuminate, 5-angled or lightly 3-5-lobed, scabrous above; fr. small, not variegated or otherwise marked and in this differing from *M. scabra*. Trop. Amer: variable.

WILHELM MILLER.
L. H. B.†

MENÍSCIUM (Greek, *a crescent*; referring to the shape of the sori). *Polypodiaceæ*. A genus of about 10 tropical species allied to *Dryopteris*, usually with pinnate lvs. and with the main veins united by successive transverse arches, on which the naked sori are borne. They are warmhouse and greenhouse species. See p. 1215.

reticulatum, Swartz. Stalks 1-3 ft. long, stout: lvs. 2-4 ft. long, 1 ft. or more wide, pinnate; pinnae 1-4 in. wide, with an acuminate apex, naked or slightly pubescent; main veins 1-1½ lines apart, with 8-12 transverse arches. Mex. and W. Indies to Brazil.

L. M. UNDERWOOD.

MENISPERMUM (Greek, *moonseed*). *Menispermaceæ*. MOONSEED. Hardy and attractive semi-woody climbers.

Twining glabrous or slightly pubescent vines, with alternate long-petioled lvs., which are peltate near the margin, and axillary or super-axillary panicles or cymes of small dioecious not showy fls.; fr. a berry-like drupe, containing a flattened crescent-shaped or curved stone (whence the name moonseed): stamens 9-24, with 4-loculed anthers in the staminate fls., 6 and sterile in the pistillate fls.; pistils 2-4, with broad stigmas; sepals 4-8, in 2 series; petals 6-8, shorter than the sepals.—

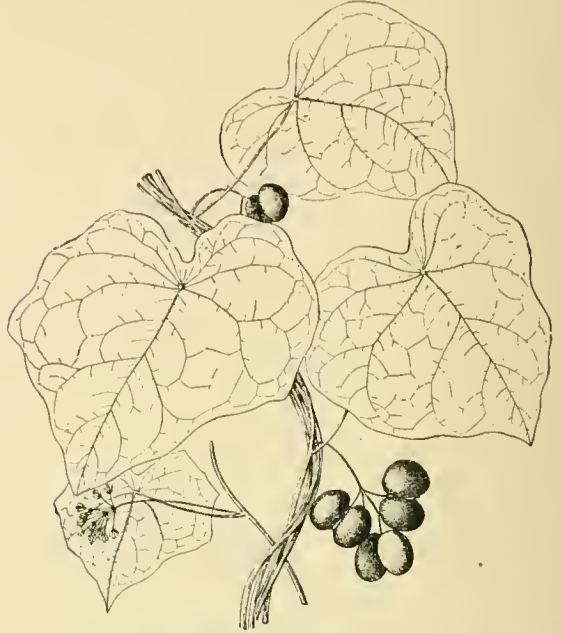
As conceived by the early botanists, *Menispermum* contained many species which are now referred to *Cocculus*, *Abuta*, *Cissampelos*, *Tinospora*, *Ananirta* and other genera. The genus is now considered to be bitypic, one species in N. Amer. and the other in Siberia, China and Japan. (Diels, in Engler's *Pflanzenreich*, hft. 46, 1910.) Both the moonseeds are neat and interesting vines, and are hardy in the northern states and Ont. Prop. readily by seeds; or plants of *M. canadense* may be dug from the wild. Cuttings of ripened wood may also be used.

canadense, Linn. COMMON MOONSEED. Fig. 2357. Sts. slender and terete, woody below, flocculent-pubescent when young, but becoming glabrous, twining 10 ft. or more high: lvs. variable in shape, round-ovate to ovate-cordate, sometimes entire, but usually angulate-lobed, the long petiole attached just inside the margin:



2357. Leaf of *Menispermum canadense*. (×½)

fls. greenish white, in loose straggling panicles, the sepals and petals usually 6, the stamens in the male fls. 10-20: fr. bluish black, ¼ in. diam., resembling small grapes. Rich soils in thickets and lowlands, Que. to



2358. *Menispermum dauricum*. (×½)

Manitoba and south to Ga. and Ark. B.M. 1910. G.M. 57:153. G.W. I, p. 63, F.E. 22:493; 28:261.

dauricum, DC. Fig. 2358. In habit much like the above but more vigorous: glabrous: lvs. smaller, distinctly peltate, deeper green, cordate and angular: fls. in cymes, yellowish, the terminal ones with 6 sepals, 9 or 10 petals and about 20 stamens, the lateral ones with 4 sepals, 6 petals and about 12 stamens. S. E. Siberia, Korea, China, Japan. G.F. 5:233 (adapted in Fig. 2358).—Variable. Rarely planted in this country.

L. H. B.

MÉNTHA (from the Greek name of the nymph Minthe). *Labiataæ*. MINT. Strong-scented perennial herbs; grown mostly for their essential oils but sometimes for ornament.

The term mint, often applied to various species of *Labiataæ*, is most frequently used to designate plants of the genus *Mentha*. This genus is characterized by its square sts. and opposite simple lvs. in common with others of the family, and especially by its aromatic fragrance, its small purple, pink or white fls., with mostly regular 10-nerved calyx, slightly irregular 4-cleft corolla and 4 anther-bearing stamens, crowded in axillary whorls and the whorls often in terminal spikes; ovary 4-parted, style 2-cleft: nutlets ovoid and smooth.—Many forms have been described, and the synonymy is extensive. About 30 species are now recognized, all native in the North Temperate Zone, about half of them being native or naturalized in N. Amer. Six species are cult. more or less for the production of aromatic essential oil, which is found in all parts of the herb, and especially in minute globules on the surface of the lvs. and calyx. Some of the species hybridize freely, producing innumerable intergrading forms which make the limitation of certain species difficult.

The mints are scarcely horticultural subjects, although *M. rotundifolia* and *M. Pulegium*, as well as the little *M. Requienii*, may be used as border plants or ground-covers and for the ornamental foliage of some

of the forms. They propagate readily by cuttings and division; some of them produce stolons.

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<i>gibbaltarica</i> , 7.	<i>Requienii</i> , 1.	<i>vulgaris</i> , 2.
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A. *Plant a miniature creeper.*

1. *Requienii*, Benth. A minute creeping herb from Corsica, used as a carpeter: sts. filiform, ascending: lvs. small, stalked, orbicular: fls. mauve or pale purple in loose few-fl'd. whorls: plant peppermint-scented.

AA. *Plant larger, erect or tall, or in forms of some species perhaps compact.*

B. *Whorls of fls. in terminal spikes or some in the upper axils.*

c. *Spikes thick: lvs. petioled.*

D. *Lvs. lanceolate, acute.*

2. *piperita*, Linn. PEPPERMINT. Perennial by runners and rootstocks: sts. erect or ascending, 1-3 ft. high, branched, glabrous: lvs. lanceolate, acute, sharply serrate, 1-3 in. long, glabrous or pubescent on the veins beneath, punctate, with minute oil globules: fls. in thick, terminal spikes, 1-3 in. long in fr. the central spike finally exceeded by the lateral ones; calyx glabrous below, its sharp teeth usually ciliate; corolla purple, rarely white, glabrous. Eu.—Intro. into cult. from England and sometimes naturalized in moist ground. Known as "American mint" or "state mint" in N. Y.

Var. *officinalis*, Sole. WHITE MINT. Slender, 1-2 ft. high: lvs. 1-2 in. long: sts. and foliage light-colored. Not known in wild state; long cult. in England and sparingly intro. into cult. in Amer.

Var. *vulgaris*, Sole. BLACK MINT. Rather stout, 2-3 ft. high: lvs. 2-3½ in. long: sts. usually purple and foliage dark-colored. Native in England.—Cult. in recent years in England, Saxony and Amer.

DD. *Lvs. ovate or subcordate.*

3. *citrata*, Ehrh. BERGAMOT MINT. Perennial by leafy stolons, glabrous throughout: st. decumbent, 1-2 ft. long, branched: lvs. thin, broadly ovate and obtuse or the uppermost lanceolate and acute: fls. in the uppermost axils and in short, dense, terminal spikes; calyx glabrous, with subulate teeth; corolla glabrous. Sparingly naturalized from Eu. in N. Y., N. J., Fla. and Ohio.—The fragrant lemon-scented oil is distilled for use in making perfumes.

CC. *Spikes slender, interrupted: lvs. sessile or nearly so.*

D. *Plant glabrous: lvs. lanceolate.*

4. *spicata*, Linn. (*M. viridis*, Linn.). SPEARMINT. Fig. 2359. Perennial by leafy stolons: st. erect, with ascending branches 1-2 ft. high: lvs. lanceolate, sharply serrate, 2½ in. or less in length: whorls of fls. in narrow, interrupted spikes 2-4 in. long, the central spike exceeding the lateral ones; calyx-teeth hirsute or glabrate. Widely naturalized about old gardens throughout the older settled parts of the U. S.; native in Eu. and Asia.

DD. *Plant pubescent: lvs. elliptic or ovate-oblong.*

5. *rotundifolia*, Huds. ROUND-LEAVED MINT. Perennial by leafy stolons, pubescent throughout, somewhat viscid: sts. slender, erect or ascending, simple or

branched, 20-30 in. high: lvs. subcordate at base, mostly obtuse, crenate-serrate, 1-2 in. long and about two-thirds as wide, reticulated beneath: fls. in dense or interrupted spikes 2-4 in. long; calyx pubescent; corolla puberulent. Naturalized from Eu., in moist waste places from Maine to New Mex.—Sometimes used as a substitute for peppermint or spearmint. Var. *variegata*, Hort., with variegated lvs., is used in low borders.

BB. *Whorls of fls. all axillary.*

c. *Plants usually decumbent or prostrate at base: fls. nearly sessile.*

6. *canadensis*, Linn. AMERICAN WILD MINT. Perennial by runners and rootstocks: st. usually pubescent, with spreading hairs, erect or ascending, simple or branched, 6-30 in. high: lvs. ovate-oblong or lanceolate, glabrous or nearly so, 2-3 in. long, slender-petioled, the petioles often exceeding the nearly sessile whorls of light purple fls.: calyx pubescent. In wet soil or in water at the margins of streams. New Bruns. to Brit. Col. and southward to Va. and New Mex.—Often called peppermint, for which it is frequently mistaken and for which it is sometimes used as a substitute. It is variable in habit and also in the character of its oil.

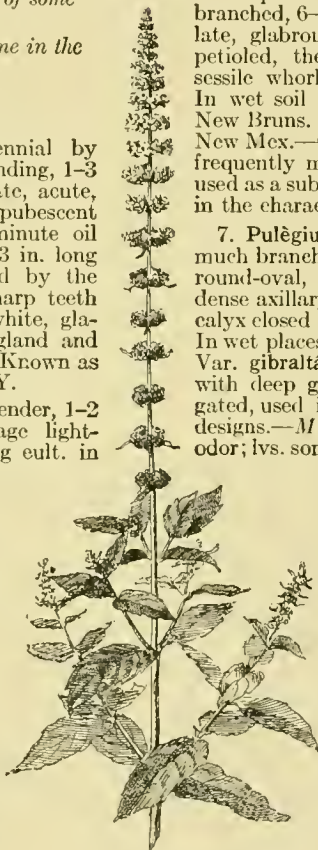
7. *Pulegium*, Linn. PENNYROYAL. Prostrate, much branched: lvs. small, about ½ in. or less long, round-oval, entire or slightly erenate, hairy: fls. in dense axillary whorls, small, bluish lilac; mouth of calyx closed by hairs; upper lobe of corolla notched. In wet places, Eu. and W. Asia, and intro. elsewhere. Var. *gibbaltarica*, Hort., is a dwarf compact form with deep green foliage which is sometimes variegated, used in rock-gardens and also in geometrical designs.—*M. Pulegium* has a strong and agreeable odor; lvs. sometimes used for seasoning. It is sometimes grown in kitchen-gardens, preferring a moist rather stiff soil. Prop. by division. The American pennyroyal is *Hedeoma pulegioides*. The oil of the two is similar.

CC. *Plants somewhat rigidly erect: fls. distinctly pedicelled.*

8. *arvensis* var. *piperascens*, Malinvaud. JAPANESE MINT. Perennial by running rootstocks, puberulent or finely pubescent throughout: sts. erect, with numerous branches, 2-3 ft. high: lvs. lanceolate and acute to broadly oblong and obtuse, narrowed at the base, 1½-3½ in. long, sharply serrate, with low teeth: fls. in rather loose, axillary whorls, in distinctly pedicellate umbels, usually shorter than the slender petioles; calyx pubescent, its subulate teeth about half as long as the tube; corolla puberulent. This cult. variety is larger than *M. arvensis* itself, with larger lvs., and yields more oil. The species, *M. arvensis*, Linn., is naturalized widely from Eu.

Culture of mints for oil.

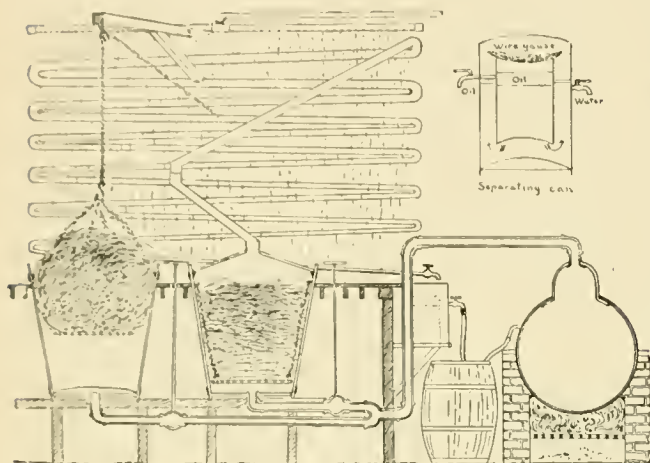
Peppermint, the most prominent economic species of mint, ranks as one of the most important of all plants in the production of essential oils. It was originally native in Great Britain and possibly in continental Europe, but is now widely naturalized, growing in many places on both continents like a native plant. There is no record of it in America previous to its introduction to Connecticut in the early part of the eighteenth century. From there it was taken to western New York and to the Western Reserve in Ohio, and in 1835 "roots" were taken from Ohio to Pigeon Prairie,



2359. *Mentha spicata*—Spearmint. (X ½)

in Michigan, where the industry has grown to larger proportions than anywhere else. Peppermint is now cultivated commercially in southwestern Michigan and adjacent parts of northern Indiana, Wayne county, New York, and in Mitcham, Surrey and Lincolnshire, England, and in Saxony.

Peppermint plants may be grown on any land that will produce good crops of corn, but its cultivation is most profitable on muck soils of reclaimed swamps. It is an exhaustive crop, and on uplands is rarely included



2360. A mint still.

in the rotation more often than once in five years. On deep, rich muck soils it is often grown consecutively 6 years or more with no apparent diminution in yield. Peppermint is propagated by pieces of running rootstocks, commonly called "roots." These are planted, as early in spring as the ground can be prepared, in furrows 30 inches apart. On uplands two or three crops are usually grown from one setting of the "roots," but in the swamp lands the runners are plowed under after harvest, continuing the crop indefinitely. Clean cultivation is required between the rows, and often it is necessary to hoe the plants or pull weeds by hand, especially on land that has not been well prepared. Fireweed, horseweed, ragweed and other species with bitter or aromatic properties are very injurious to the oil if cut and distilled with the peppermint.

The crop is cut either with scythe or mowing-machine in August or early September, when the earliest flowers are developed and before the leaves have fallen. In long, favorable seasons a second crop is sometimes harvested early in November. After cutting, the plants are cured like hay, then raked into windrows and taken to the stills, where the oil is extracted by distillation with steam. A "mint still" (Fig. 2360) usually consists of two retorts (used alternately), wooden or galvanized iron tubs about 7 feet deep and 6 feet in diameter at the top, each with a perforated false bottom and a tight-fitting, removable cover, a condenser of nearly 200 feet of black-tin pipe immersed in tanks of cold water, or more frequently arranged in perpendicular tiers over which cold water runs, a boiler to furnish steam and a receiver or tin can with compartments in which the oil separates by gravity. The yield of oil varies from ten to sixty pounds to the acre, averaging about twenty-five pounds for black mint, the variety now generally grown. Three kinds of peppermint are recognized: (1) American mint, "state mint" of New York (*M. piperita*), long cultivated in this country and occasionally naturalized; (2) black mint, or black mitcham (*M. piperita* var. *vulgaris*), a more productive variety introduced from England about 1889, and (3)

white mint, or white mitcham (*M. piperita* var. *officinalis*), less productive and too tender for profitable cultivation, but yielding a very superior grade of oil. Peppermint oil is used in confectionery, very extensively in medicines, and for the production of menthol, or more properly pimenthol. Pimenthol differs in physical properties from menthol derived from Japanese mint.

Japanese mint, secured from *M. arvensis* var. *piperascens*, is cultivated in northern Japan, chiefly on the island of Hondo; not known in the wild state. It has been introduced experimentally in cultivation in England and the United States, but has not been cultivated commercially in these countries. Its oil is inferior in quality to that of *Mentha piperita*, but it contains a higher percentage of crystallizable menthol, of which it was the original source and for the production of which it is largely used. It is propagated by rootstocks carefully transplanted and cultivated by hand-labor. Two crops, rarely three, are obtained in a season, and by abundant fertilizing and intensive culture large yields are obtained. It is usually continued three years from one planting, and then a rotation of other crops follow for three to six years. Three horticultural varieties are recognized, being distinguished chiefly by form of leaf and color of stem. The variety known as "Akakuki," with reddish purple stem and broad, obtuse leaves, is regarded as best.

Spearmint is cultivated on peppermint farms for the production of oil. The plants are propagated and cultivated similar to peppermint and distilled in the same stills. The oil, for which there is a smaller demand than for peppermint, is used chiefly in medicine and to some extent as a flavoring ingredient in chewing-gum and drinks. Spearmint is cultivated in the vicinity of many large cities to supply saloons, where freshly cut sprigs of the plant are used in making the seductive and intoxicating drink known as "mint julep." The plant is more widely known as an ingredient in "mint sauce," the familiar accompaniment of spring lamb and green peas. To supply this demand it is often cultivated in the kitchen-garden. It is easily propagated by the perennial rootstocks, and persists year after year with little care, thriving in nearly all kinds of soil, providing it does not become too dry.

LYSTER H. DEWEY.
L. H. B.†

MENTZELIA (Christian Mentzel, 1622-1701, German botanist). *Loasaceae*. Showy-flowered plants, some of the herbaceous kinds grown as flower-garden subjects.

Herbs annual and perennial, shrubs and even small trees, glabrous or setose, the sts. often becoming white and shining; lvs. usually alternate, mostly coarsely toothed or pinnatifid; fls. solitary or in racemes or cymes, white, yellowish, yellow or red; petals 5, regularly spreading, convolute in the bud, deciduous; stamens indefinite, rarely few, inserted with the petals on the throat of the calyx; seeds flat, in a caps. dehiscent at the summit.—Species probably 60-70 in the Americas. A good number are native in the U. S. They thrive in sunny moist or dry situations sheltered from strong winds. *M. Lindleyi*, from Calif., is frequent in eastern gardens, where it is commonly known as *Bartonia aurea*; the other species are offered by western dealers, but are not generally in cult. They flower in summer. Although interesting and showy, these plants have not become popular with gardeners. The seeds should be sown where the plants are to remain, as they do not bear transplanting. *M. bartonioides*, Benth & Hook., is Eucnide (which see); *M. gronovifolia*, Fisch. & Mey., is the same. By some authors, part of the species are separated as *Nuttallia*; also as *Hesperaster*.

A. Plant herbaceous.

B. Color of fls. white, creamy white or yellowish white.

decapétala, Urban & Gilg (*Bartonia decapétala*, Pursh. *M. ornata*, Torr. & Gray. *Nuttallia decapétala*, Greene). Biennial or perennial, 2 ft. and more: lvs. 2-6 in. long, oval, lanceolate or oblong, sinuate-pinnatifid; fls. 5 in. across, opening toward night, fragrant, usually bracted; petals 10; stamens 200-300; caps. oblong, with numerous seeds. Dakota and Mont. to Texas. B.M. 1487. R.H. 1878:430.

nuda, Torr. & Gray (*Nuttallia nuda*, Greene). Biennial or perennial, st. somewhat slender, 1-5 ft. high: lvs. 1-3 in. long, lanceolate or oblong-lanceolate, acute, strongly dentate or pinnatifid; fls. opening toward night, creamy white, $1\frac{1}{2}$ - $2\frac{1}{2}$ in. across, usually bractless; petals 10. Mont., Kans., and Texas. B.M. 5483 (as *Bartonia nuda*).

BB. Color of fls. yellow.

Lindleyi, Torr. & Gray (*M. Bartonia*, Steud. *Bartonia aurea*, Lindl.). Fig. 2361. Annual: st. 1-4 ft. high, simple or branched and straggling; lvs. 2-3 in. long, narrow-lanceolate to ovate, coarsely toothed or pinnatifid; fls. about $2\frac{1}{2}$ in. across, bright yellow, very fragrant in the evening, bracted, opening in evening and remaining the following morning; petals 5, broadly obovate, nearly as broad as long, rounded at the apex except an abrupt short point. Calif. B.M. 3649. B.R. 1831. Gn.W. 21:504.

laevicaulis, Torr. & Gray. BLAZING STAR. Biennial: st. stout, $2\frac{1}{2}$ - $3\frac{1}{2}$ ft. high: lvs. 2-8 in. long, narrow-oblong to lanceolate, sinuate-toothed; fls. yellow, $2\frac{1}{2}$ -3 in. across, bractless; petals lanceolate or oblanceolate, acuminate. Wyo. to Calif.

AA. Plant shrubby.

Conzattii, Greenm. Woody, 20 ft. and more: st. whitish; lower lvs. nearly opposite and upper alternate, simple, oblong-lanceolate, acuminate, finely dentate, the base entire and narrowed into a short petiole, scabrous above and tomentose beneath; fls. 2 in. across, brilliant yellow and showy, cymose-paniculate; calyx deeply 5-lobed; petals 5, ovate-oblong, short-acuminate. S. Mex. Listed in S. Calif. L. H. B.†

MENYANTHES (Greek, probably meaning *month flower*; perhaps because it flowers for about a month). *Gentianaceae*. BUCKBEAN. Perennial bog-plants.

As understood by the older botanists, the genus has two species, one of which is widespread in the U. S., and the other in the Pacific N.W. to Japan, but later botanists separate the latter plant as *Nephrophyllidium* (*N. crista-galli*, Gilg). *Menyanthes* has creeping rootstocks and small, 5-lobed white or purplish fls. in late spring. It is allied to *Nymphoides*, but the fls. of the latter are not bearded or crested on the face as they are in *Menyanthes*. Lvs. all alternate, stalked; corolla somewhat funnel- or bell-shaped; stamens inserted on the tube of the corolla; hypogynous glands 5; style long.

trifoliata, Linn. BUCKBEAN. About 9-18 in. high: lfts. 3, oval or oblong-obovate, to 3 in. long; raceme 12-20-flid.; caps. small, ovoid. Bogs, temperate regions in N. Amer., Eu., and Asia. G.M. 43:335. G. 35:559. V. 2:198; 3:208.—The lvs. are said to be used in Germany as a substitute for hops in beer-making. A very interesting bog-plant, growing often in shallow water.

L. H. B.

MENZIËSIA (after Archibald Menzies, surgeon and naturalist). *Ericaceae*. Low deciduous shrubs, allied to *Rhododendron*, with small 4-merous fls. appearing with the lvs. in terminal clusters: corolla urceolate or bell-shaped, 4-lobed; stamens 8: fr. a 5-valved caps. with many linear caudate seeds. Seven species in E. Asia and N. Amer. Interesting shrubs for alpine rockeries, but not particularly ornamental. *M. pilosa*, Juss.

(*M. globularis*, Salisb.), is sometimes offered by dealers in native plants. Shrub, 2-6 ft.: lvs. oval to oblong-obovate, glandular-mucronate, entire, strigose, ciliate, 1-2 in. long; fls. few, drooping, on slender glandular pedicels; corolla yellowish, often tinged reddish, $\frac{1}{4}$ in. long; anthers included. May, June. Pa. to Ga. in the mountains. B.M. 1571. For cult., see *Andromeda* and *Rhododendron*.

M. corymbosa, Swartz = *Phyllocladus corymbosa*.—*M. empetrifolmis*, Smith = *Phyllocladus empetrifolmis*.—*M. pendula*, Maxim. Shrub, to 4 ft.: lvs. elliptic; fls. subglobose, greenish white; anthers exserted. Japan.—*M. polifolia*, Juss. = *Daboecia polifolia*.

ALFRED REIDER.

MERATIA (after François Victor Mérat, French physician and botanist, 1780-1851). Syn., *Chimonanthus*. *Calycanthaceae*. Ornamental shrubs, grown chiefly for their early sweet-scented flowers; grown out-of-doors.

Deciduous or evergreen, with scaly winter-buds; lvs. opposite, without stipules, short-petioled, entire; fls. long before the lvs., on scaly branchlets axillary on branches of the previous year, with numerous imbricate sepals and without petals; stamens 5 or 6, short, with innate anthers; pistils many, inclosed in a hollow receptacle which develops into a caps-like fr. with numerous achenes.—Two species in China. Often united with *Calycanthus*, which is easily distinguished by its naked winter-buds and the numerous stamens of the fls. which appear at the end of leafy shoots.

The species in cultivation is a deciduous shrub, in milder climates nearly evergreen, with generally oblong lustrous leaves and with fragrant yellow flowers with purple center appearing before the leaves in early spring. It is hardly about as far north as Philadelphia and likes a warm and sheltered position. See *Calycanthus* for cultivation and propagation.

præcox, Rehd. & Wilson (*Calycanthus præcox*, Linn. *Chimonanthus fragrans*, Lindl.). Lvs. elliptic-ovate or oblong-lanceolate, acuminate, bright green, lustrous above, glabrous beneath, 3-5 in. long; fls. very fragrant, $1\frac{1}{2}$ - $1\frac{1}{2}$ in. broad, outer sepals yellow, inner ones striped purplish brown. Feb., March. China, Japan. B.M. 466. L.B.C. 7:617. L.D. 3:173. G.C. III. 11:213. Gn.M. 5:141. Var. *grandiflora*, Rehd. & Wilson (*Chimonanthus fragrans* var. *grandiflora*, Lindl.). Fls. much larger and brighter-colored. B.R. 451.—The evergreen *M. nitens*, Rehd. & Wilson (*Chimonanthus nitens*, Oliver), with long-acuminate lvs. and smaller and paler fls. (H.I. 16:1600) is not yet introduced.

ALFRED REIDER.



2361. *Mentzelia Lindleyi*. ($\times \frac{1}{2}$)

MERCURIÀLIS (from Mercury, who is supposed to have discovered some virtue in the plant). *Euphorbiaceæ*. **MERCURY**. Herbaceous plants of temperate regions, of little importance horticulturally. Lvs. opposite, simple; fls. apetalous, very small, in axillary clusters; calyx valvate; stamens 8-20, anther-cells spherical, attached by the apex and hanging; styles undivided; ovary 2-3-celled, 1 ovule in each cell. About 7 species, mostly in the Medit. region. Related to *Mallotus* and *Acalypha*. *M. annua*, Linn., is a weed in Eu. *M. perennis*, Linn., is a European poisonous plant, the foliage yielding an unstable blue dye.

J. B. S. NORTON.

MERENDÈRA (from *quita meriendas*, Spanish name of *Colchicum autumnale*; some of these plants formerly considered to belong to *Colchicum*). *Liliaceæ*. Small spring-blooming plants, classed as "bulbs," little grown.

About 12 species of bulbous plants, mostly natives of the Medit. region and Asia, one in Abyssinia. They



2362. Flowering branch of *Merope angulata*. (Natural size)

belong to the same tribe with *Colchicum* and *Bulbocodium*, but *Colchicum* has a real corolla-tube, while the other two genera have 6 very long-clawed segms. which are merely connivent, forming a loose tube at first and afterward separating. In *Merendera* there are 3 styles which are distinct from the base, while in *Bulbocodium* the style is 3-cut only at the apex. *Merenderas* are low stemless plants with tunicated corms: lvs. linear, appearing with the fls.: fls. 1-3, appearing in spring or fall, mostly lilac-colored. The genus is divided by Baker into two groups, based on the anthers. The 2 species described below belong to the group with small, oblong, versatile anthers, which are fastened at the middle rather than the base. They are hardy spring-blooming plants with about 3 lvs., and fls. 1-1½ in. across. These plants are procurable from Dutch bulb-growers. They are pretty, small-fl., hardy, fragile plants which persist well under good garden cultivation. The garden names are confused. *M. ruthenica* is probably *Bulbocodium ruthenicum*, which is a form of *B. vernum*.

A. Blade of petals oblanceolate, obtuse.

caucásica, Bieb. Lvs. 3-4, with the fls.: the 3 outer corolla-segms. appendaged on each side at the junction

of blade and claw: new corms sessile. Caucasus, Persia. B.M. 3690.

AA. Blade of petals lanceolate, acute.

sobolifera, Fisch. & Mey. Lvs. 3, appearing with the fls.: segms. not appendaged: a very small new corm produced at the apex of a shoot. Asia Minor, Persia.—The plant cult. under this name is *Colchicum procurrens*, Baker, which differs from the *Merendera* in having a long perianth-tube, autumnal fls., and lvs. appearing in spring. The true *M. sobolifera* may not be in cult.

WILHELM MILLER.

L. H. B.†

MÉROPE (named for Merope, one of the Pleiades). *Rutaceæ*. **KIGERUKKAN**. A curious and as yet little-known salt-resistant plant related to *Citrus*, of interest for trial as a stock.

Small spiny tree: lvs. simple, thick and leathery; spines in pairs in the axils of the lvs.: fls. white, 5-merous with 10 free stamens: frs. triangular, having large flattened seeds imbedded in the sticky mucilaginous pulp.—Only one species is known.

angulata, Swingle (*Citrus angulata*, Willd. *Sclerostylis spinosa*, Blume. *Paramignya angulata*, Kurz.). Fig. 2362. A small spiny tree bearing curious angular frs. and growing in the tidal swamps in S. Java: lvs. coriaceous, thick, 3-5 x 1-1½ in., borne on simple petioles: fls. white, 5-parted with 10 free stamens, pistil projecting beyond the stamens: frs. triangular, 1-2 in. long, in cross section approximately an equilateral triangle ¾-1 in. on a side. Illus. Kurz., Journ. As. Soc. Bengal, 42 pl. 18 (1874). Valetton, Icon. Bogor, 4: pl. 348 (1912). Swingle, Journ. Wash. Acad. Sci. 5:420, figs. 1, 2 (1915).—This peculiar thick-lvd. plant thrives in saline soils and is being tested as a stock for other citrus frs. by the U. S. Dept. Agric.

WALTER T. SWINGLE.

MERTÉNSIA (after Franz Carl Mertens, a German botanist). *Boraginaceæ*. Attractive herbs for colonizing and for borders.

Perennials, glabrous or pubescent: lvs. alternate, often having pellucid dots: racemes terminal or the cymes loose, few-fl., 1-sided, sometimes panicle; fls. blue or purplish, rarely white, with funnel-form or campanulate corolla that is either crested or unappendaged in the throat, the lobes 5 and similar and not much spreading or the margin nearly entire; calyx 5-cut or 5-parted; stamens attached at the middle of the tube or higher; ovary 4-lobed, the style filiform: frs. 4 erect more or less wrinkled nutlets.—Species probably 40, in the cooler parts of the northern hemisphere, a good part in N. Amer. In recent years, the American species have been much redescribed. They are often very smooth plants, of attractive habit and bright colors. The most popular species is *M. virginica*, Virginia cowslip, bluebells, and Virginia lungwort. This grows 1-2 ft. high and bears more or less drooping clusters of blue-bell'd fls. in March to May. The fls. are about 1 in. long, and 20 or more in a terminal group. They have a purple tube and blue bell of distinct shape, the lobes of the corolla being little pronounced.

The common *mertensia* (*M. virginica*) is one of the plants that should remain undisturbed for years, and hence is suited to the rocky and to margins and ravines. It is unusually good for colonizing in woods. Its leaves die down soon after flowering-time. The plant should have a sheltered position and rich loamy soil. *M. sibirica* (of gardens) is considered by some even more desirable. The flowers are later, light blue, and not so distinctive in form. The foliage of *M. sibirica* lasts through the summer. *Mertensias* may be propagated by seed if sown as soon as ripe, but with uncertainty by division. Although of secondary importance, *mer-tensias* add variety to the border and are nearly always attractive to plant-lovers.

While *Mertensia virginica* grows well in full sun, it does almost as well in shady situations. It makes its growth early in the spring before the shade under the trees becomes very dense, and the foliage, which disappears after blooming, seems to ripen as readily in the shade as in the open. As large masses of this plant are effective, and as the blank left by the disappearing foliage precludes its being grown in the open border, it is fortunate that it will adapt itself to shady places where its yellowing foliage may be somewhat hidden and its absence during the summer be unnoticed. (W. C. Egan.)

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A. Plant fleshy, glaucous and very smooth.

1. *maritima*, S. F. Gray (*Pneumaria maritima*, Hill. *Pulmonaria maritima*, Linn.). LUNGWORT. On sea-coasts from Mass. northward and in Eu. and Asia, likely to be planted in seaside places but apparently not in the trade: a spreading or ascending plant with branches 1 ft. or so long: lvs. fleshy, ovate to spatulate and oblong, entire, upper surface becoming blistered: fls. $\frac{1}{2}$ in. or less long, blue or whitish.

AA. Plant not prominently fleshy, smooth or essentially so. (Nos. 9 and 10 may be sought here).

B. Fls. trumpet-shaped, the open part not prominently 5-lobed; filaments much longer than the anthers.

2. *virginica*, DC. (*M. pulmonarioides*, Roth). VIRGINIAN COWSLIP. BLUEBELLS. Fig. 2363. Vol. III, pl. LIII. Very smooth and glabrous, 1-2 ft.: lvs. obovate or oblong, or the lowest large, rounded and long-stalked; veins conspicuous: fls. at length more nodding than shown in Fig. 2363. Spring. N. Y. and westward to S. C. and Tenn., usually inhabiting low or moist grounds. B.M. 160 (as *Pulmonaria*). Gn. 23, p. 463, and 32, p. 173. J.H. III. 43:210. G. 6:115. Gn.M. 15:306. V. 3:181; 7:244; 11:180; 12:140. Mn. 4:33. Var. *rubra*, Hort., has pink-colored fls.

BB. Fls. with the upper part more bell-shaped and prominent spreading lobes; filaments shorter than the anthers or only a little longer.

3. *oblongifolia*, Don. About 12 in. high, smooth or very nearly so: lvs. mostly oblong or spatulate-lanceolate, somewhat succulent, veins inconspicuous: fls. blue in a rather close cluster, the corolla-tube 2-3 times length of the limb and also of the calyx; calyx-lobes acute. Mont. to Wash.—Not easy to cult.

4. *sibirica*, Don. Glabrous, 1-5 ft. high: lvs. roundish or broadly elliptic, somewhat fleshy, the upper ones very acute or acuminate and ovate: fls. purplish blue, in long racemes; the fls. sometimes vary to white. E. Siberia. Gn. 18:514.—Offered by some American dealers.

5. *ciliata*, Don. The N. American plants heretofore referred to *M. sibirica* are now separated as *M. ciliata*, being specially marked by a short calyx with oval or oblong obtuse ciliate lobes: glabrous, pale and glaucous, very leafy, 1-3 ft.: lvs. oblong or lance-ovate, ciliate on the margins, mostly acute or acuminate, the basal ones ovate or subcordate: fls. bright blue, the tube 3-5 times as long as the calyx-lobes. Rocky Mts. W. and N.; also in the trade. G. 27:661.—A handsome species, with bell-shaped blossoms and pinkish buds.

6. *paniculata*, Don. Greener than *M. sibirica*, roughish and more or less pubescent: st.-lvs. ovate to oblong-lanceolate: fls. blue, in loosely panicle racemes; calyx-lobes acute, lanceolate or linear. Lake Superior and north, E. Asia. B.M. 2680 and B.R. 146 (as *Pulmonaria paniculata*).

7. *alpina*, Don. Mostly smooth and somewhat glaucous but sometimes pubescent, only a few inches high: lvs. oblong, spatulate or lanceolate, somewhat obtuse, the cauline sessile: fls. blue, crowded, corolla $\frac{1}{4}$ - $\frac{1}{2}$ in. long, the tube rarely exceeding the corolla-limb and equally or slightly exceeding the lanceolate calyx-lobes; anthers nearly sessile. Subalpine places in the Rocky Mts.

AAA. Plant not prominently fleshy, more or less hairy (at least the lvs.).

B. Corolla-tube little if any longer than calyx.

8. *papillosa*, Greene. Sparingly leafy, 12 in. or less high: lvs. oblong and revolute, densely papillose (with many minute projections) and hairy above, smooth beneath, scabrous on margins: fls. blue, panicle, the corolla small and almost tubular, with a narrow limb and shallow lobes. Mountains of Colo.—Offered in the W.

9. *elongata*, Benth. (*M. echioides* var. *elongata*, Hort.?). Sts. 8 in., hairy: lvs. somewhat hairy, oblong



2363. *Mertensia virginica*. In early stage of anthesis; becoming nodding or pendulous. ($\times \frac{1}{2}$)

to spatulate, the cauline sessile: fls. blue, in many-fl. elongating racemes, the corolla-tube little exceeding the calyx, the throat bearing very small scales and the lobes spreading. Kashmir. G.C. III. 47:390 (as *M. echioides* var. *lanceolata*).

BB. Corolla-tube conspicuously longer than calyx.

10. *lanceolata*, DC. Dwarf, 8 in. or less high: lvs. closely or minutely pubescent on upper surface but otherwise glabrous, glaucescent, spatulate to lance-linear, somewhat fleshy: fls. blue (buds pink) in early spring, loosely panicle; corolla-tube hairy within at the base, usually nearly twice as long as calyx. Plains and hills, Wyo., Colo.—Offered W., as a choice rock-plant, thriving in any light soil.

11. *primuloides*, Clarke. Dwarf, the st. about 3-6 in. long and very leafy below, hairy: lvs. small, elliptic or lanceolate, the lower ones very short-petioled: fls. about $\frac{1}{2}$ in. across, indigo-blue passing into white and yellow, on very short pedicels in few-fl. dense short racemes, the corolla-tube twice longer than calyx, the throat bearing distinct scales. High Himalayas. Gn. 69, p. 319. F.S.R. 1:246. Var. *chitralensis*, Hort., has larger and more deeply colored fls. N. W. India.

12. *echioides*, Benth. St. 12 in. more or less: plant soft-hairy: lvs. oblong to spatulate, the lower ones long-

petioled, somewhat obtuse; fls. deep blue in dense many-fl'd. racemes, the corolla-tube one-third longer than calyx, with no scales in the throat, the lobes of corolla erect. Himalaya.

WILHELM MILLER.

L. H. B.†

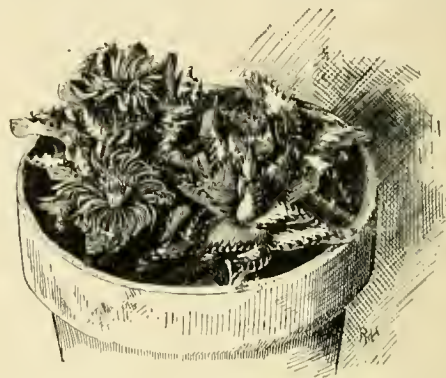
MÉRYTA (from the verb *to roll*, because of the character of the male fls.). *Araliaceae*. Glabrous small trees of the S. Pacific Isls., perhaps 15 species, with large alternate simple coriaceous lvs.; fls. dioecious, small, in terminal panicles, the sterile with 4 or 5 stamens, the fertile with 4- to many-celled ovary; petals 4 or 5; calyx-limb none or minutely toothed. *M. Sinclairii*, Seem. (*Botryodendrum Sinclairii*, Hook.), the PUKA, is one of the rarest plants in New Zeal., but is considerably planted in the northern part where it makes a striking round-headed evergreen tree to 25 ft. high, with large oblong or obovate shining lvs. crowded near the ends of the branches and terminal stout panicles of greenish white fls.; fr. small, $\frac{1}{2}$ in. or less long, succulent, black. It is intro. in England, and is well worth trying in Calif. G.C. III. 34:422; 45:2. *M. Dénhamii*, Seem., has been cult. for some time at Kew and is used as a stock on which to graft *Aralia* (*Dizygotheca*?) *Veitchii*. It is a tree growing 30 ft. or more, with variable narrow lvs. a ft. or two long. S. Sea Isls. B.M. 7927. L. H. B.

MESEMBRYANTHEMUM (Greek, *midday flower*; the flowers usually open in sunshine and close in shadow). Sometimes spelled *Mesembrianthemum*. *Aizoaceae*. FIG-MARIGOLD. Mostly low-growing succulents, grown as pot subjects under glass or in window-gardens and sometimes planted out in summer; some kinds are good bank-covers in mild climates.

Annual or perennial prostrate or erect herbs, and sometimes subshrubs, with thick fleshy usually opposite lvs. which are 3-angled, terete or flat, and with entire or more or less spiny margins; fls. white, red or yellow, mostly terminating the branches, usually opening in full sun but a few expanding in the evening; calyx mostly 5-parted, the lobes usually lf.-like and unequal; petals very many, linear, in 1 to many rows, united at the base; stamens very numerous, also in many rows and united at base; ovary mostly 5-celled (but variable); caps. 5- to many-celled, stellately dehiscent at the summit, becoming baccate, hygroscopic; seeds very numerous.—*Mesembryanthemum* includes some 300 and more species, nearly all of which are S. African, according to Sonder "abounding throughout the arid plains and sands of the whole country to the south of the Orange River and west of the Great Fish River." Four species are described by Bentham in *Flora Australiensis*. Two (*M. crystallinum* and *M. equilaterale*) are native in Calif. Others occur in New Zeal., Canaries, Arabia and the Medit. region. They are allied botanically to the caetaceous series, although lacking the spines of those plants and bearing true lvs. Horticulturally, they are fanciers' plants, and are classed with "succulents." Very few are in the general trade, although a number are advertised in Calif. and others are in botanic gardens. As with most succulents, the species are not well understood botanically, owing largely to the difficulty in making herbarium specimens. Many of them are of odd and grotesque form. One species, *M. crystallinum*, is a common house-plant, being known as ice-plant, but it is one of the least showy in fl. It is grown for the thick glistening foliage. It prop. readily by seed or division. The best available account of the mesembryanthemums is Sonder's elaboration of the S. African species (293 numbers) in *Flora Capensis*, Vol. II (1861-2), from which the following treatment has been largely taken. Sonder writes that "the caps. are tightly closed in dry weather and open naturally after rain. If thrown into water until it becomes thoroughly soaked and then removed, an old caps. will open out its capillary valves, radiating from a center like a star; and will close them again when dry. This experiment may be repeated

several times without destroying their remarkable hygrometric property."

In sunny and semi-arid regions the fig-marigolds are very appropriate and attractive, covering the soil with plump foliage and giving a display of brilliant colors. They are also used more or less in bedding-out on south borders and exposures in cooler and moister climates.



2364. *Mesembryanthemum fetinum*. ($\times \frac{1}{3}$)

M. edule has extensively run wild in many parts of the world and is useful in covering banks and holding loose sands. It withstands some frost. Any number of species may be found in the collections of fanciers, and many not described below are mentioned in periodical literature, but they need not be entered here as they are really not horticulturally known. See *Succulents*.

The cultivation of the fig-marigolds should consider their natural conditions. They are found in their native habitats growing most luxuriantly on dry barren rocky places and on dry sandy plains. They are succulent plants with thick fleshy leaves, and are therefore able to stand the severe drought they have to put up with in those arid places. Knowing that these plants delight in dry arid situations gives the key to their cultivation. When grown in pots, care should be taken that the pots are well drained. A light sandy loam, mixed with brick rubbish broken small, makes a good compost for them. In summer they may be placed out-of-doors in a slightly elevated and sunny position, where they will produce an abundance of their showy blossoms. On the approach of cold weather in autumn they may be placed in a cool greenhouse with a dry atmosphere and plenty of air. Very little water is needed during the dull months of winter. Some of the species make good window plants. *M. cordifolium* var. *variegatum* is largely grown for edgings for beds. *M. pomeridianum* and *M. tricolorum* are good showy annuals. Propagation is effected either by cuttings or by seeds. Cuttings should be dried in the sun for two or three days before they are inserted in sand. (Robert Cameron.)

In the following account, the species are all South African unless otherwise specified.

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A. EPAPULOSA: Plant not bearing glittering papillæ or projections (species 1-35).

B. Plant stemless or nearly so.

C. Lvs. 2, minute, united into a globe.

1. *minimum*, Haw. Stemless, when cult. often somewhat caulescent, obconical, with confluent rather branched dots: fls. whitish; petals connate at base; ovary exserted. G. 1:437.

CC. Lvs. distinct.

D. Fls. yellow (Nos. 2-12).

E. Lvs. 4-6, semi-terete at the base, thickening and triquetrous at the apex.

2. *tigrinum*, Haw. TIGER'S JAW. Stemless or essentially so: lvs. cordate-ovate, 2 in. or less long, glaucous green and marbled with white, the upturning edges with long, soft, ciliated teeth, the keel entire: fls. nearly sessile, large, yellow. B.R. 260. Gng. 16:227. G.L. 19:138; 27:226. A.F. 30:376.

3. *felinum*, Haw. Fig. 2364. Lvs. triquetrous, rhomboid-lanceolate, 2 in. or less long, but narrower than in the last, somewhat glaucous, faintly dotted with white, the edges with 8 ciliate teeth; keel entire: fls. nearly sessile, yellow.

EE. Lvs. 4-6, triquetrous, thickened from the base to the middle, but tapering to the apex.

4. *albinatum*, Haw. Stemless: lvs. curved-triquetrous upward, with a recurved mucro or spine at the apex, bearing elevated whitish dots: fls. sessile, yellow.

EEE. Lvs. half-cylindrical, of various sizes or forms on the same plant, in alternate pairs.

5. *angustum*, Haw. Nearly or quite stemless, small: lvs. 2-ranked, linear, tongue-shaped, long, keeled at the apex, somewhat unequal, one of them straight-acute and the other hooked: fls. nearly sessile, yellow.

6. *bigibberatum*, Haw. Rather caulescent: lvs. small, scarcely tongue-shaped, very smooth, usually with 2 gibbosities, subequal, one attenuated and acute, the other keeled-dilated, obtuse at the apex: petals denticulate.

7. *Salmii*, Haw. Nearly stemless: lvs. decussate, attenuate, one acute, the other oblique and blunt, 6-8, with a white spot at the inside of base: fls. sessile.

EEEE. Lvs. tongue-shaped, with one margin thicker than the other, of two or more forms, 2-ranked.

F. Peduncle less than 1 in. long.

8. *linguæforme*, Haw. Lvs. unequally tongue-shaped, deflexed and somewhat falcate, becoming depressed when old, flattish above, obliquely attenuate: fls. yellow. Index Kewensis makes the *M. linguæforme* of Haworth synonymous with *M. obliquum*, Willd., and uses Linnaeus' *M. linguiforme* as a tenable name.

9. *uncatum*, Salm-Dyck. Nearly stemless: lvs. narrow tongue-shaped, 2½ in. long, thick, incurvate-uncinate at apex: fls. yellow; petals revolute.

FF. Peduncle 1 in. or more long.

10. *cultratum*, Salm-Dyck. Lvs. 2-ranked, thick,

tongue-shaped and curved like a pruning-knife, blunt at the apex: fls. yellow, on a somewhat 3-angled peduncle.

11. *depressum*, Haw. Prostrate: lvs. narrow, tongue-shaped, recurved-depressed, acute: fls. yellow, with petals somewhat recurved.

12. *pustulatum*, Haw. Lvs. 2-ranked, narrow, tongue-shaped, long and ascending, blunt, bearing pustules near the base: fls. yellow.

DD. Fls. white or reddish.

13. *pubescens*, Haw. Almost stemless: lvs. silky-pubescent, semi-cylindrical, oblique at apex: fls. bright rose-red. Gt. 59:1579 and p. 13.

14. *calamiforme*, Linn. St. 1-2 in. long, woody: lvs. glaucescent, cylindric, with a much-thickened base: fls. in short stout peduncles, solitary, white with pink tips, 2½ in. across. B.M. 7775.

BB. Plant with an evident erect or prostrate st.

C. Foliage-lvs. distinct or essentially so (not truly perfoliate nor connate).

D. St. or caudex prostrate.

E. Branches angular: lvs. acinaciform with smooth angles.

F. Peduncle with 2 bracts.

15. *acinaciforme*, Linn. St. articulate, 2-3 ft. long, the young growth compressed: lvs. opposite, 2-3 in. long, scimitar-shaped (curved and thicker on one edge), the keel dilated: fls. purple, about 4 in. across, "the largest in the genus," the stignas 14: fr. size of a gooseberry, and eaten by Hottentots. Gn. 62, p. 362. Gt. 59, p. 15.—Handsomer.

16. *rubrocinctum*, Haw., is probably a form of the last, differing in having a red line on the keels of the lvs. B.R. 1732.

17. *æquilatère*, Haw. Differs from *M. acinaciforme* chiefly in thinner lvs. and smaller fls.: sts. several feet long, often forming large mats: lvs. 3-sided, thicker than broad, to 2 in. long: fls. fragrant, to 2 in. across, bright rose-purple, showy and fragrant. Native to Austral., Tasmania, Chile and Calif. Grows on dunes and banks near the sea.

FF. Peduncle without bracts.

18. *edule*, Linn. Fig. 2365. St. angular: lvs. opposite, 3-4 in. long, triquetrous, curved, the keel serrate:



2365. *Mesembryanthemum edule*.—Hottentot fig.

fls. large, yellow or purple, the stamens 8; fr. edible, being one of the Hottentot figs.—Grows well on the sea-cliffs in S. England, making long hanging masses (Gn. 55, p. 235, with picture); also used in Calif. and elsewhere to hold sand-and to provide ground-cover. Gn. 71, p. 600.

EE. Branches angular or terete; lvs. subcinaciform, with serrulated angles.

19. *serrulatum*, Haw. St. shrubby, when young erect; branches ascending; lvs. triquetrous rather glaucous, thick; fls. purplish; petals bidentate, a little longer than the calyx-lobes.



2365. *Mesembryanthemum aureum*. ($\times \frac{1}{2}$)

DD. St. or at least the branches, erect or prominently ascending.

E. Fls. yellow, orange or copper-color.

20. *aurantiacum*, Haw. St. becoming 1 ft. or more high, much branched, sometimes decumbent at base, the branches somewhat compressed; lvs. 1 in. or less long, smooth and glaucous, bluntly triquetrous; fls. orange, with petals $\frac{3}{4}$ in. long and in about 3 series.

21. *aureum*, Linn. Fig. 2366. Larger: lvs. $1\frac{1}{2}$ –2 in. long, cylindrically triquetrous, smooth and glaucous, mucronate; fls. golden, 2 in. across, the petals in many series. B.M. 262.—In this and the last, the lower lvs. are often rarely connate at the base.

EE. Fls. rose-color or purplish.

F. Lvs. triquetrous, carinal angles drawn out, often lacerate; branches 2-edged.

22. *mutabile*, Haw. With straw-color or reddish tortuous, erect branches; lvs. about $\frac{1}{2}$ in. long, compressed-triquetrous, incurved, the keel entire, apex acute; fls. mostly solitary on an upwardly thickened peduncle, rose-color, the inner short petals pale yellow.

23. *inclaudens*, Haw. Distinguished from the last by scimitar-shaped lvs. and broader petals; lvs. crowded, green, compressed-triquetrous and scimitar-shaped (thicker on one edge).

24. *lacerum*, Haw. St. erect, branches spreading; lvs. glaucous, $1\frac{1}{2}$ –2 in. long; fls. often solitary, large; petals numerous, inner ones short, exterior ones longer than calyx, rose-colored.

25. *heteropetalum*, Haw. St. and branches erect-spreading; lvs. glaucous, subfalcate; fls. small, solitary, rarely geminate; petals pale red or whitish, interior ones very short.

FF. Lvs. subtriquetrous, elongated, acute, very smooth; branches erect, rigid.

26. *blandum*, Haw. Two ft., with numerous branches; lvs. distant, 2 in. or less long, compressed-triquetrous, but with equal sides, narrow, minutely dotted, acutish; fls. 2 in. across, pale rose, the petals toothed. B.R. 582. L.B.C. 6:599.

FFF. Lvs. subconnate, triquetrous, with equal sides, gradually attenuated; branches suberect.

27. *spectabile*, Haw. St. prostrate, but branches ascending; lvs. 2–3 in. long, crowded, glaucous, incurved and spreading, triquetrous, attenuate and mucronate; fls. purplish; petals 1 in. long, the inner somewhat shorter. B.M. 396. G.W. 14, p. 649.

FFFF. Lvs. falcate-recurved, with obtuse angles.

28. *falciforme*, Haw. One to 2 ft., branches spreading; lvs. much crowded, triquetrous, angles acute; fls. in 3's or solitary, $1\frac{1}{2}$ in. diam., showy; petals in many series, lanceolate; filaments white. J.H. III. 50:493.

29. *roseum*, Willd. To 2 ft. high, branches spreading, leafy; lvs. attenuate on both ends, incurved; fls. in 3's or solitary, showy; petals pale rose-colored, in two series. Gn. 62, p. 363.—One of the common species in Calif., extensively used in parkings and in terraces where it is difficult to secure a grass sod, and for covering rocks behind retaining-walls. If given water, the foliage has a rather dark green color, but if grown without watering it is grayish green and the fls. are somewhat smaller although not less brilliant.

FFFFF. Lvs. compressed-triquetrous, with dilated keel near recurved apex, not toothed.

30. *caulescens*, Mill. Shrub to $1\frac{1}{2}$ ft.; lvs. incurvate-erect, glaucous, acutish, with the sides obtuse, toothed and the keel entire; fls. in 3's, or often solitary; petals obtuse, emarginate.

31. *muricatum*, Haw. St. suberect; plant bluish; lvs. less than $\frac{1}{2}$ in. long, somewhat incurved, deltoid and toothed, very glaucous; fls. small and fragrant, the petals acute.

cc. Foliage-lvs. truly connate or perfoliate.

d. Lvs. triquetrous.

32. *uncinatum*, Linn. St. diffuse, much branched; lvs. sheathing at base, glaucous-green, punctate, short and equal-sided, triquetrous, often furnished with 1 or 2 spines underneath at the apex; fls. on short, thick peduncles, $\frac{1}{2}$ in. diam., rose-colored. Hardy in England.

33. *acutangulum*, Haw. St. shrubby, with rigid and erect branches; lvs. sheathing, $\frac{1}{2}$ in. long and about as long as the internodes, glaucous green, triquetrous, compressed near the apex, somewhat incurved; fls. white, small, in a panicle.

DD. Lvs. elongated, subulate or somewhat cylindrical.

34. *stipulaceum*, Linn. Dwarf, with erect, decussate branches; lvs. $1\frac{1}{2}$ –2 in. long, very slender, crowded, spreading and recurved, very glaucous; fls. in the axils, mostly solitary, purplish.

35. *Léhmaunii*, Eckl. & Zeyh. Branches compressed, ascending; lvs. spreading, subconnate, turgidly triquetrous, without dots, very smooth, glaucous; fls. terminal, solitary, on short peduncles, 1– $1\frac{1}{2}$ in. diam.; calyx 6-cleft; petals in many rows, interior ones shorter, pale yellow.

AA. PAPULOSA: Plant usually bearing glittering papillæ, vesicles or projections on sts. and lvs.,—hence the popular name ice-plant (species 36–51).

b. Lvs. flat.

c. Stigmas 5.

d. Root annual or biennial (cult. as annuals).

36. *crystallinum*, Linn. ICE-PLANT. Fig. 2367. A common plant in window-gardens and hanging-baskets and readily grown from seeds (which are offered by seedsmen), procumbent; lvs. flat, fleshy, ovate or long-spatulate, usually clasping, undulate, covered with glistening dots or elevations; fls. small, whitish or varying to light rose-color. S. Afr., Greece, Canary Isls., S. Calif. G. 2:147.—Grown for its glistening foliage. Fls. open in the sun.

37. *pinnatifidum*, Linn. f. Sts. diffuse: lvs. obovate, 1-2 in. long, lyrate pinnatifid: fls. axillary, solitary, pedunculate; petals as long as calyx, yellow. B.M. 67.

DD. Root annual.

38. *pyropæum*, Haw. (*M. tricolor* and *M. tricolorum*, Hort.). Almost stemless, branched from the base: lvs. connate, radical or rising from the base of the st., linear-elongate, semi-cylindrical: fls. solitary, pedunculate, variable in color from light pink with red eye to self-colored white, pink and red. B.M. 2144. G.C. III. 43:42. G.M. 54:299.

DDD. Root perennial and the st. becoming somewhat woody.

39. *cordifolium*, Linn. Sts. 1-2 ft., diffuse, minutely papillose: lvs. opposite, 1 in. or less long and nearly as wide, cordate-ovate, somewhat papillose: fls. solitary, peduncled, purple, the petals short and linear. A var. *variegatum* is in cult., and is a good half-hardy trailing plant.

CC. Stigmas 10-20.

40. *pomeridianum*, Linn. St. simple or forking, the branches ascending, hairy on branches, peduncles and calices: lvs. lance-spatulate or spatulate, narrowed into a petiole, ciliate: 2 of the calyx-lobes longer than the petals; petals linear-lanceolate. B.M. 540.

41. *glabrum*, Ait. Glabrous: lvs. lance-spatulate, petiolate and dilated at base: fls. straw-colored, darker at the eye; lobes of the calyx linear and unequal.

BB. Lvs. terete or nearly so.

C. Branches hispid or bristly.

42. *subcompræsum*, Haw. Erect, 2 ft.: lvs. not crowded, $\frac{3}{4}$ in. or less long, narrow, very blunt, greenish canescent, flattened-terete: fls. solitary, purplish; calyx-lobes unequal.

43. *floribundum*, Haw. Tortuous in growth, the branches not over 6 in. long, more or less decumbent: lvs. less than 1 in. long, very narrow, terete, curved, obtuse, a little thicker toward the apex: fls. small, axillary, rose-color, the 5 styles exserted, the petals twice longer than the calyx.

CC. Branches not hispid.

D. The lvs. barbate at the apex.

44. *barbatum*, Linn. A foot or more tall, diffuse and decumbent: lvs. not crowded, $\frac{1}{2}$ in. long, spreading,

46. *dénsum*, Haw. Much like the last: lvs. longer, flattish above and convex beneath, ciliate also at the base: calyx longer: fls. reddish violet. R.H. 1869, p. 356.

DD. The lvs. punctate-scabrous.

47. *élegans*, Jacq. (*M. deflexum*, Haw.). Shrubby, 6-12 in. or more tall, branchy, whitish or red: lvs. crowded, $\frac{1}{2}$ in. long and very narrow, very glaucous, scabrous: fls. numerous, mostly panicle, pale red (or whitish), the petals $\frac{1}{2}$ in. long.

48. *polyanthum*, Haw. Subshrub to 1 ft., much branched: lvs. much crowded, erect-spreading, very narrow, compressed-semiterete, bluish glaucous, prominently dotted: fls. very numerous, ternately panicle; petals rosy violet.

49. *violaceum*, DC. Distinguished from the preceding by the more robust, erect st., less diffuse branches, lvs. longer and a little incrassate: fls. numerous, very long-peduncled, ternately panicle; petals entire, twice longer than calyx, violet.

DDD. The lvs. minutely papulose.

50. *subincanum*, Haw. Root woody, branched, fibrous: st. erect, branched: lvs. connate, spreading, without dots or papulae, recurved and mucronulate at the apex: fls. trichotomous, subcorymbose, fragrant, white.

51. *Ecklōnis*, Salm-Dyck. Root woody, branched: st. and branches pubescent, at length glabrate: lvs. depressed triquetrous, minutely papillate and hairy: fls. in 2's or 3's, subtrichotomous, $\frac{1}{2}$ in. diam., white.

L. H. B.

MESOSPINDIUM (Greek compound; meaning obscure). *Orchidaceæ*. Plants with the habit of a slender odontoglossum, with sheathing leaves at the base of the pseudobulbs.

Flowers in racemes on panicles; sepals and petals sub-similar, expanded; labellum with 2 longitudinal ridges, adnate to the column, with rounded lateral lobes and a narrow middle lobe; column long or short; pollinia 2, seated on a rhomboid pedicel. These plants are evergreen coolhouse orchids, and thrive well in baskets of peat and moss, with plenty of water. The plants cult. as *Mesospinidium* are referred by some to the genus *Cochlidia*. *Mesospinidium* has about 5 species, of which the following is often cult.

sanguineum, Reichb. f. Pseudobulbs oval, 2-lvd., mottled: lvs. ligulate, sharp-pointed, shorter than the many-fl. drooping panicle: fls. numerous, small, vivid rose; the lower sepals are partially united, oblong; petals cuneate-ovate. Peruvian Andes. B.M. 5627.

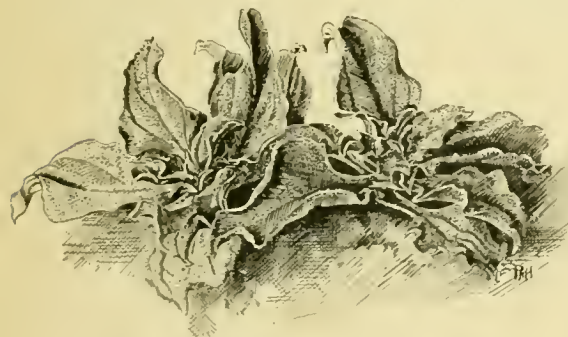
M. vulcanicum, Reichb. f., is described as *Cochlidia vulcanica* (Vol. II, p. 809), its proper name.

HEINRICH HASSELBRING.

MÉSPILUS (Greek substantive name of doubtful significance). *Rosacæ*. **MESPIL.** MEDLAR. Woody plants, grown in Europe for the edible fruit and sometimes planted in this country.

From *Pyrus*, with which this genus is sometimes united, *Mespilus* differs in bearing the fls. singly on leafy growths of the season (the frs., like the quince, having no true detachable peduncles as do pears and apples), and in having the top of the ovaries not covered by the over-growing receptacle, and the pyrenes readily separable. There is but one species of true *Mespilus*, although some authors (e.g., Focke, in Engler & Prantl's "Die Natürlichen Pflanzenfamilien") include some of the *Crataegus* species in the genus. From *Crataegus* it differs in its fr. (as from *Pyrus*), in the large fls. borne singly, and the more leaf-like calyx divisions.

germánica, Linn. MEDLAR. Fig. 2368. The only recognized species; small tree, or sometimes only shrub-like, thorny in the wild but usually unarmed in cult.: lvs. simple and nearly sessile, lance-oblong or



2367. Common ice-plant—*Mesembryanthemum crystallinum*. ($\times \frac{1}{4}$)

green and pellucid, semi-cylindrical, with 5 or 6 hairs at the end: fls. solitary, reddish, the petals entire and 2-3 times longer than the calyx.

45. *stellatum*, Mill. Three or 4 in. high, fleshy and tufted: lvs. crowded, $\frac{1}{2}$ in. long, glaucous, semi-cylindrical, scabrous, with many hairs at the apex: peduncles hairy: fls. reddish violet, the calyx campanulate, $\frac{1}{4}$ in. long.

elongated-oblong, pubescent, serrate; fls. large and sessile on short leafy shoots, white or pinkish, pubescent outside; styles usually 5, glabrous and distinct; top of the hypanthium pubescent; fr. a pome with open top bearing a more or less hairy disk and from which the pyrenes or stones partially or slightly protrude. Var. *gigantëa*, Kirchn. (var. *macrocarpa*, Hort.), is a large-fruited form.

Var. *abortiva*, Kirchn. (var. *apyrëna*, Koch), is a seedless form. Cent. and S. Eu. to the Caucasus, and also wild in England but probably not indigenous there. G. 4:363. It hybridizes with *Crataegus* (see *Crataegus* - *Mespilus*, Vol. II, p. 878).

The medlar is grown to a considerable extent in parts of Europe for its acid fruits, but in this country it is very little known. It is perfectly hardy in central New York, and its cultivation requires no special treatment or skill. It makes a twiggy tough-wooded bush or small tree, 10 to 15 feet high, bearing large

white blossoms late in May or early in June, after the leaves are full size. The foliage is soft and luxuriant. The fruit (Fig. 2368) remains hard and austere until mellowed by frosts. With the freezing and the incipient decay, the fruit becomes brown and soft. It is usually picked after it is touched by frost and laid away on shelves or in drawers in a cool dry room; the ripening process which follows is known as bletting. When finally softened, it is agreeable for eating from the hand, particularly for those who enjoy fruit-acids. It also makes good preserves. Medlars are easily raised from seeds, although seeds (like those of *Crataegus*) may not germinate the first year. On these stocks the named varieties may be grafted or budded. Medlars may also be worked on pear, thorn (*Crataegus*) or quince. The Dutch or Hollandish and the Nottingham are the leading varieties. The fruit of the former is often 2½ inches in diameter. The latter is much smaller, but is better in quality. There is also a seedless variety, and two variegated forms.

M. arbutifolia, Linn.=*Aronia arbutifolia*.—*M. grandiflora*, Smith=*Crataegus grandiflora* (see Vol. II, p. 888).—*M. japonica*, Thunb.=*Eriobotrya japonica*.—*M. Pyracantha*, Linn.=*Pyracantha coccinea*.—*M. Smithii*, DC.=*Crataegus grandiflora*.

L. H. B.

MESQUIT of Mexico is *Prosopis juliflora* (Leguminosæ). A picture of a mesquit forest is shown in G. F. 1:116.

METAPLÉXIS (Greek, referring to relationships of the corona parts and stamens). *Asclepiadaceæ*. Three twining shrubs of Japan, N. China and Siberia, little grown: lvs. opposite, cordate; fls. medium or small, in pedunculate clusters. *M. Staintonii*, Roem. & Schult. (*M. chinensis*, Deene. not Turcz.), has acuminate undulate lvs.; racemes extra-axillary, peduncled, the fls. pale rose or greenish white, small; likely to kill to the ground and to send up long herbaceous blooming shoots. China. G. 32:661.

METHÓNICA: *Gloriosa*.

METROSIDÉROS (Greek, *heart of iron*; this and other genera of the myrtle family are called ironwoods). *Myrtaceæ*. BOTTLE-BRUSH. Trees and shrubs, some-

times climbers, more or less planted for the showy red or white long-stamened flowers.

Leaves coriaceous, mostly opposite, sometimes dichotous; fls. red, crimson, or white, mostly in terminal cymes or racemes; petals 5, spreading; stamens very numerous, 1 in. or more long, much longer than the petals; ovary 3-celled, with filiform style; fr. a coriaceous caps., inclosed in the persistent calyx-tube or protruding, the seeds numerous, linear.—The species described below are coolhouse shrubs, and are rarely grown outdoors in the S. The genus has about 20 species, half in New Zeal., and others in Pacific Isls. and Austral., 1 in S. Afr. Some of the species are brilliant when in bloom, although they have been only sparingly intro. to cult. *M. robusta* is the remarkable "rata" of New Zeal., of which Cheeseman writes: "A magnificent tree, sometimes reaching a gigantic size, specimens having been measured with trunks over 20 ft. diam. It usually (but not invariably) commences life as an epiphyte in the upper branches of some tall forest-tree, sending to the ground aerial roots, which coalesce and form a trunk after the death of the supporting plant. Terrestrial specimens are frequently seen, but these either have no trunk at all, keeping during life the habit of a much-branched bushy shrub, or produce a short, hard, and durable wood, which is much employed for wheelwrights' work, framework for machinery, wagons, etc., and for shipbuilding."

The plants belong to the class of Australasian shrubs whose chief beauty lies in their long red stamens. They are somewhat grown for a fancy Easter trade by florists, largely from imported stock. They are allied to *Callistemon*, and at least some of the *M. floribunda* of the trade is *C. lanceolatus*. In *Metrosideros* the flowers are borne in dense two- or three-forked cymes, while in *Callistemon* they are borne in spikes. In Fig. 745 (page 630) the plant is shown with apparently terminal inflorescence, but the branch is really terminated by the leaf-buds, which develop later. *M. semperflorens*, Lodd.=*Callistemon lanceolatus*.—*M. speciosa*, Sims=*Callistemon speciosus*.

The plant known to the trade as *Metrosideros robusta*, Fig. 2369, and which is probably *Callistemon lanceolatus*, has been grown for many years as a cool greenhouse plant, but it is only within recent time that Europeans have been sending American florists the compact little bushes that arrive with the azaleas. The city florist can perhaps dispose of one of these bottle-brushes for every ten plants of *Azalea indica*. Plants in 6-inch pots, well flowered, fixed with a red ribbon and placed in a modern basket, certainly look novel and attractive. The Belgians grow the young plants in peat, as they do most hard-wooded plants, but they do very well in good turfy loam with a fourth of leaf-mold. Cuttings of the young growth may be struck in early spring and planted out in good soil by the end of May, but it is cheaper to import stock. When the plants arrive, soak the ball of roots, pot firmly and place them in a house of about 45°. Freshly imported plants cannot be forced in much heat, like azaleas, or they will shed their flowers. Watch them carefully, give them more heat gradually and they will bloom for Easter. Plants unsold the first spring will be much more satisfactory the second year. By the end of April cut them



2368. Medlar—*Mespilus germanica*. (Natural size)



2369. *Metrosideros floribunda* of the trade, but *Callistemon lanceolatus* of the botanists.

back to within 1 or 2 inches of the old growth, put them in a good heat and keep them syringed. They will make a bushy growth, with a good number of shoots. Early in June plunge them in a sunny spot outdoors, with the rim of the pot well covered, and be careful that they do not suffer for water in hot weather. In July, or earlier, mulch the pots with an inch of half-decomposed cow-manure. Before frost, remove the plants to a temperature of 45° or warmer if bloom is desired before Easter. (William Scott.)

A. *Fls. red.*

robusta, A. Cunn. Large forest tree, to 100 ft., with an irregular trunk: lvs. opposite, elliptic-ovate to elliptic-lanceolate, 1-1½ in. long, glabrous, very coriaceous, obtuse, veiny, with an extra nerve near each margin and parallel: fls. dark scarlet, many in broad and dense terminal cymes; calyx top-shaped. New Zeal. B.M. 4471 (erroneously as *M. florida*). R.B. 24:269.—Probably not in the trade, the plant sometimes known by this name being *Callistemon lanceolatus*. There appears to be a white-fl. form of the trade plant.

tomentosa, A. Rich. CHRISTMAS-TREE of New Zeal., because of its season of bloom, intro. into S. Calif. many years ago and now offered by nurserymen: much-branched tree to 70 ft., the short trunk becoming 5 ft. in diam.: lvs. very variable, 1-4 in. long, lanceolate to broad-oblong, acute or obtuse, very thick, usually tomentose beneath: fls. large, dark crimson, in many-fl. terminal cymes, the pedicels and calyces tomentose; stamens numerous, to 1½ in. long. J.F. 2:146.—Cheseman reports it as a "noble and picturesque tree," abundant in the N. Island of New Zeal.

AA. *Fls. yellowish red; stamens red.*

florida, Smith. "Usually a tall woody climber," writes Cheseman in the New Zeal. Flora, "reaching the tops of lofty trees." lvs. opposite, elliptic-oblong, obtuse, veiny, glabrous: fls. yellowish red or orange-red in few-fl. or many-fl. simple or branched cymes; petals orbicular; stamens scarlet, very numerous, to 1 in. long.—The typical form is not advertised, but only var. *variegata*, Hort.

M. floribunda, Hort.=*Callistemon lanceolatus*.—*M. lucida*, A. Rich., MOUNTAIN RATA, is slightly in cult. in England in an amateur way: usually a tall erect tree in New Zeal., but often a bush in subalpine or exposed places: lvs. elliptic-lanceolate or lanceolate, acuminate, very coriaceous: fls. bright crimson, in broad cymes; calyx-lobes 5, ovate and obtuse; petals oblong, surpassing the calyx-lobes; stamens numerous, 1 in. long. G. C. III. 55:450. G. 36:607.—*M. scandens*, Soland. (*M. buxifolia*, A. Cunn.), AKA, is a tall woody climber of New Zeal., with distichous, sessile, small, broadly ovate or orbicular, obtuse very coriaceous lvs. and small white fls. in 3-fl. cymes; stamens slender, ½ in. long. J. F. 1:24.

WILHELM MILLER.

L. H. B.†

METRÓXYLON (*heart wood*, in allusion to the large pith). *Palmaceæ*. SAGO PALM. A half-dozen or more species of erect monocarpic (fruiting but once) palms of the Malayan Archipelago, New Guinea and Fiji, mostly or often unarmed, ringed below, with pinnatisect lvs., allied to *Raphia*. Lvs. terminal, suberect, equally pinnatisect, the segms. opposite and linear-lanceolate-acuminate: spadix large, loosely paniculate: fls. polygamous-monoecious or perfect; corolla 3-parted, the lobes oblong; stamens 6, the filaments connate at base; ovary imperfectly 3-celled, the ovules 3; fr. subglobose or ellipsoid, 1-celled and 1-seeded.—The species and synonymy are confused. None, apparently, is in cult. within our territory. The sago of commerce is derived from the trunks of *M. leve* and *M. Rumphii*. The trunks are cut into lengths, split, and the starch washed out and subsequently heated. These grow in the Malay Is.

METTERNÍCHIA (Prince Metternich, 1772-1859, Austria). *Solanaceæ*. Probably less than a half-dozen glabrous showy-fl. trees or shrubs of the American tropics, little known in cult. and none of which appears

to be in the trade: lvs. entire, shining: fls. solitary or clustered at the ends of the branches, white or rose-red to yellowish; corolla funnelliform, tube enlarging above, the limb with 5 or 6 broad lobes; stamens 5, affixed in the base of the corolla, included or somewhat exerted; ovary sessile, 2-celled, the style filiform: caps. narrow, 4-valved. *M. Wrecklei*, Schum., Costa Rica, is recently recorded in horticultural literature: sarmentose evergreen shrub, with edible tuberous rootstock, sometimes epiphytic: lvs. ovate: fls. in terminal corymbs, like *gloxinia* in form, corolla 3 in. long and 2 in. across, fragrant, white changing to sulfur-yellow.

L. H. B.

MÈUM (an old Greek name). *Umbellifera*. SPIGNEL. One perennial herb, differing botanically from *Ligusticum* mostly in technical characters of fr., sometimes cult. for the ornamental delicate foliage. *M. athamanticum*, Jacq. (*Athamanta Mèum*, Linn.), of mountains in Eu., a glabrous tufted aromatic plant with sts. 1-2 ft.: lvs. mostly radical (cauline lvs. very few, small and less divided), pinnately decomposed, the segms. multifid and wide-spreading: fls. white, whitish yellow, or pink, in many-rayed terminal compound umbels of medium size; petals acute, narrowed at base, entire but usually with an incurved point; bracts of involucre few and narrow: fr. ½ in. long, not beaked, the carpels with 5 prominent ribs. The rootstock is said sometimes to be eaten. Prop. by seeds and division.

L. H. B.

MEXICAN TEA: *Chenopodium*.

MEYÉNIA: *Thunbergia*.

MEZERÈUM: *Daphne Mezereum*.

MEZONEÛRUM (Greek *meizos*, stronger, and *neuron*, nerve; referring to the strongly developed, winged upper suture of the pod). *Leguminosæ*. A group of about 10 species of large usually armed and often climbing shrubs or rarely trees from S. Asia, Afr. and Australasia, closely related to *Cæsalpinia*, from which it differs chiefly in its compressed indehiscent pod winged at the upper suture and the short very oblique calyx-tube with the lowest lobe enlarged and concave or all lobes connate into a tube. They can be grown only in tropical or subtropical regions. Only the following species is in cult. *M. kauaiense*, Hillebrand (*Cæsalpinia kawaiensis*, Mann. *C. kauaiensis*, Hort.). Tall shrub, to 12 ft., with spreading unarmed branches pubescent while young: lvs. bipinnate, with 2-10 pinnae, each with 9-17 oblong, obtuse and retuse lfts. about 1 in. long: fls. pinkish purple, in terminal dense racemes; calyx pinkish, glabrous, with the lowest lobe large and concave; stamens exerted, with hairy filaments: pod oblong-obovate, 3-3½ in. long, with 2-4 seeds. Hawaiian Is.—Intro. into Calif. in 1907. Called "uhuihi" in Hawaii. For cult. and prop. see *Cæsalpinia*.

ALFRED REHDER.

MICHAUXIA (André Michaux, 1746-1802, French botanist, who lived for ten years in America and wrote much on American plants). *Campanulacææ*. A half-dozen species of rather coarse-habited biennial (perhaps perennial) herbs from the Levant. Useful for borders.

Michauxia belongs, with *Campanula* and other genera of garden importance, to a group characterized by having the caps. closed at the top and opening laterally by little holes between the ribs or by small solitary valves. It is distinguished from the other genera of this group by the 8-10-parted corolla with narrow, spreading, finally reflexed lobes and an 8-10-celled ovary. *Michauxias* are erect plants, hispid or glabrous: lvs. irregularly toothed or lobed, the st.-lvs. few: fls. terminal or growing along the branches, the top ones opening first, peduncled or nearly sessile, white or pale rose.—Only 2 species are known to any extent as cult. plants.

campanuloides, L'Her. Lvs. lanceolate in outline; upper ones sessile, acute, almost clasping; calyx with reflexed appendages shorter than the lobes; stamens 8. Asia Minor. B.M. 219. G.C. III. 40:111. G.W. II. p. 199: 15, p. 595.—It grows 4-5 ft. high, has irregularly toothed, bristly-hairy foliage and large curious drooping fls., white, tinged with purple, wheel-shaped at first, later the parts reflexed. The fl. is parted nearly to the base into 8-10 oblong segms. $1\frac{1}{2}$ -2 in. long. This plant is a striking subject for the back of a hardy border. It is easily prop. by seeds (which should be fresh), and likes a well-enriched soil of a light character.

Tchihatcheffii, Fisch. & Helder. A stately plant, 6-7 ft., stout and erect, simple below; lvs. 6-8 in. long, spreading and deflexed, narrow-oblong, toothed or serrate and sometimes lyrate; fls. white, in an erect cylindric very densely fld. terminal spike; corolla-lobes 8, ovate-lanceolate, the margins fimbriate. Asia Minor. B.M. 7742. Gn. 71, p. 625; 77, p. 486. G.M. 57:594. G. 36:22. G.W. II, p. 198.—Described as biennial, and also as perennial if well cared for.

WILHELM MILLER.

L. H. B.†

MICHÈLIA (P. A. Micheli, 1679-1737, Florentine botanist). *Magnoliaceæ*. Temperate and tropical trees and shrubs, two of which (*M. fuscata* and *M. Champaca*) are cultivated in the southern states for their handsome magnolia-like foliage and red or pale yellow fragrant flowers.

Differs technically from Magnolia in the fls. mostly axillary rather than terminal, the gynophore (stipe of ovary) long and the ovules usually more than 2 in each carpel: fls. mostly axillary, solitary; sepals and petals similar, 9-15 or more, in 3 or more series; stamens as in Magnolia; carpels in a loose spike; stigma decurrent; ovules 2 or more; fr. a long, loose or crowded spike of leathery carpels, which split down the back; seeds like Magnolia.—Species about a dozen, in Asia.

Only one michelia has attained any prominence in this country. This is *M. fuscata*, one of the most popular garden shrubs in the southern states. It is known as the brown-flowered or banana shrub; also *Magnolia fuscata*. It is shrubby in habit, attains a height of 10 to 15 feet and is perfectly hardy in the middle and lower South. The shining young twigs and petioles are covered with brown tomentum. The flowers are 1 to $1\frac{1}{2}$ inches across, brownish yellow, edged with light carmine, exhaling a strong banana fragrance. The flowering period extends from the end of April until June. Propagate by seeds as stated for *Magnolia grandiflora* (p. 1965), but as seed is somewhat scarce, the better method is from ripened wood cuttings, under glass and with bottom heat. The cuttings should have one or two leaves left, and be cut before very cold weather. It is a very desirable conservatory shrub in northern sections. (P. J. Berckmans.)

A. Fls. pale yellow.

Champaca, Linn. A tall tree native of the Himalayas, with pubescent branchlets; lvs. ovate-lanceolate, tapering to a long point, 8-10 in. long, $2\frac{1}{2}$ -4 in. broad, shining above, pale and glabrous or puberulous beneath; petiole $1\frac{1}{2}$ in. long; fls. 2 in. across; sepals oblong, acute; petals linear: fr. 3-4 in. long.

comprèssa, Sarg. (*Magnolia comprèssa*, Maxim.). Tree, to 40 ft., with smooth dark bark; lvs. oblong or narrow-obovate, narrowing into long petioles, obtuse or short-pointed, entire, coriaceous, lustrous above, 3-4 in. long; fls. fragrant, yellow, about 1 in. across; sepals and petals narrow-obovate; anthers nearly sessile; head of pistils stipitate; fr.-cone 2 in. long. Japan, a northern species. G.F. 6:77.

AA. Fls. brownish.

fuscata, Blume (*Magnolia fuscata*, Andr.). Young growths brown-pubescent; lvs. elliptic-lanceolate or

elliptic-oblong, smooth at maturity; fls. small, erect, brown-purple, very fragrant; none of the sepals or petals linear. China. B.M. 1008.

L. H. B.†

MICHOŁÍTZIA ("sent home by Micholitz when collecting in India and Burma"). *Asclepiadaceæ*. A genus founded in 1909 by N. E. Brown, allied to *Marsdenia* but differing in the calyx-lobes being valvate and the corona-lobes tubercle-formed and spreading. The single species, *M. oboordata*, N. E. Br., from India, is said to possess no horticultural value. It is a small undershrub with milky juice, rather small oboordate or obovate lvs. and small fls. with olive-green tube and reddish lobes.

MICÒNIA (D. Micon, Spanish physician). *Melastomaceæ*. Glasshouse subjects, notable for the handsome foliage.

A Trop. American genus of trees and shrubs, with large and showy opposite or verticillate strongly veined lvs.: fls. relatively small, usually corymbose or



2370. *Miconia magnifica*. Known to the trade as *Cyanophyllum magnificum*.

paniculate, white, rose, purple or yellow; petals 4-8, rounded at the apex, spreading or reflexed; stamens variable in number and shape, but usually 8-16, the anthers polymorphous; fr. a dry or leathery berry, 2-5-loculed, and few- or many-seeded.—Cogniaux (DC. Monogr. Phaner. 7) admits 518 species to this genus, including the plants known to the trade as *Cyanophyllum*. Krasser (Engler & Prantl, III:7) reduces the group to a subgenus or section of *Tamonea* (but subsequently restored), the latter genus comprising at that time (1898) about 550 species in Trop. Amer. Many species have been described recently. The most popular of the greenhouse plants, *Cyanophyllum magnificum*, is placed by Cogniaux among the species that are imperfectly known and is not described in the monograph, although it was illustrated and described as long ago as 1859. See *Tamonea*.

The miconias of gardeners are conservatory or warm-house subjects, grown for their large and striking foliage. They belong to the old genus *Cyanophyllum*, in which the anthers are subulate and incurved and with a single pore, the flowers large and the calyx oblong

or campanulate and truncate or dentate. They propagate by cuttings of the firm wood over bottom heat. The plants should be screened from the direct glare of the sun, and be given abundance of water. Use a fibrous soil. Since the plants are known to gardeners mostly for their foliage, it is probable that some of the trade species are referred to wrong genera. Flowers are not always known when the plants are named. Some of the names have no standing in botanical literature. For culture, see *Melastoma* and *Medinilla*.

magnifica, Triana (*Cyanophyllum magnificum*, Hort.). Fig. 2370. Reaching several feet in height as grown under glass (probably a tree in its native place), robust: lvs. very large (becoming 2-2½ ft. long), broad-ovate and wavy-edged, arched, rugose, upper surface lustrous green, lower surface red, the very prominent veins white or light-colored; fls. small, paniced. Mex. R.H. 1859, p. 359.—Discovered by Ghiesbrecht and first shown by Linden in 1857. One of the best and most striking of all conservatory foliage subjects. Voss (Blumengärtnerei) refers this species to the genus *Tamonea* and calls it *T. magnifica*, Voss. **M. velutina**, Lind. & Rod. (L.H. 41:21), of Brazil, is perhaps a form of it; the lvs. are not arched and colors are more bronzy.

spectánda, Rod. (*Cyanophyllum spectándum*, Nichols.). Lvs. oval, 1½ ft. or less long, 6-7 in. broad in the middle, the upper surface dark lustrous green, under side greenish red, the midrib prominent and gray. Brazil.

denticuláta, Naudin (*Melastoma denticulátum*, Bonpl., not Hort.). Branches obtusely 4-angled; the young branches, lvs. and calyx furfuraceous; lvs. narrow-ovate, somewhat obtuse, 3-nerved, base rounded, minutely serrulate; fls. pedicellate, aggregated in panicles; petals subrotund, small; calyx somewhat hemispherical. Ecuador.

L. H. B.

MICRÁNTHUS (*small flower*). *Acanthaceæ*. Two genera, one iridaceous and one acanthaceous, bear the name *Micranthus*. The acanthaceous genus now becomes *Phaulopsis* (or *Phaylopsis*), which see. The iridaceous genus *Micranthus* comprises two species from the Cape, allied to *Watsonia* but differing in the very short tube of the small straight perianth, the fls. in long dense distichous spikes. They appear to be not in regular cult. The species are *M. spicátus*, Pers., rose-colored, and *M. plantaginicus*, Eckl., blue.

MICROCÍTRUS (from the Greek for *small* and *Citrus*). *Rutaceæ*, tribe *Citrea*. Small spiny trees or shrubs, closely related to *Citrus*, but differing in having dimorphic foliage, very small fls., free stamens, very short pistil, few-celled ovary and in the presence of cataphylls in the seedling.

Four species of this new Australian genus (see Swingle in Jour. Wash. Acad. Sci. 5:570) are at present known.

australásica, Swingle (*Citrus australásica*, F. Muell.). **FINGER-LIME**. Spiny shrub or small tree, 15-30 or even 40 ft. in height, native to the mountain scrubs of N. New S. Wales and Queensland: juvenile lvs. very small, oval or ovate, on stiff spreading branchlets; mature lvs. small, obovate, cuneate or rhomboidal, ½-1½ x ½-¾ in.; frs. finger-shaped, 2½-4 x ¾-1 in., smooth-skinned. Ill. Wash. Acad. Sci. 5:572, figs. 1-4.—Young plants of the finger-lime are very ornamental, having successive tiers of horizontal spiny branchlets with juvenile foliage somewhat like a young *araucaria*. They flower and fruit when but a few years old. The finger-shaped frs. contain a rather disagreeably pungent acid juice. This species is promising for breeding purposes because of its hardiness. It is also promising for use as a hedge plant in warm climates because of its dense spiny branches, dwarf habit, and ability to grow from cuttings. A variety of this species (*M. australásica* var. *sanguinea*), the red-fruited finger-lime, has blood-red frs. with a pinkish pulp.

Gárrowayi, Swingle (*Citrus Gárrowayi*, F. M. Bailey.) **GARROWAY'S FINGER-LIME**. Small spiny tree from N. Queensland: juvenile lvs. very small, on stiff spreading branchlets; frs. oval, 2-2½ x 1-1¼ in., rough-skinned, 5-celled.—This species, recently introduced into this country, is very closely related to *M. australásica*.

austrális, Swingle (*Citrus austrális*, Planch.). **DOOJA**. Round-fruited Australian lime, native to the subtropical coastal forests of New S. Wales and Queensland: juvenile lvs. linear, on flexuose branches; mature lvs. ovate or elongate-rhomboidal, 1-2 x ½-¾ in.; frs. round, rough-skinned, 1-2½ or even 3 in. diam., 5- (rarely 6- or 7-) celled. Ill. Penzig, Studi s. Agrummi, pl. 21, figs. 8-12.—The dooja is one of the most interesting Australian citrous frs. It reaches a height of 30 to 60 ft. and bears frs. said to reach 2½ or even 3 in. diam. The growing shoots and immature lvs. on plants cult. in the open are of a deep wine-red color. Because of its vigor this species is of interest for use as a stock. It shows considerable resistance to winter cold in Calif.

inodóra, Swingle (*Citrus inodóra*, F. M. Bailey). **THE RUSSELL RIVER LIME**. A spiny tree, bearing ribbed frs., native to Queensland: lvs. large, 3-7 x 1½-2½ in., lanceolate, not articulated with the petiole which is very short; fls. inodorous; frs. ribbed, 2-2½ x 1¼ in., oval, 8-celled. Ill. Bail. Fl. Queensland, 1, pl. 10, 1899.—The Russell River lime in the wild state bears edible frs. said to equal in flavor the West India lime. This has not yet been intro. into culture. WALTER T. SWINGLE.

MICROCŶCAS (*small cymas*). *Cycadaceæ*. One species in Cuba, differing from *Zamia* in the character of the floral scales (masculine scales plane and obtuse, the feminine thickened at the apex and truncate); caudex cylindrical, covered with bases of the petioles. *M. calécoma*, A. DC. (*Zamia calécoma*, Miq.), has a dwarf trunk and lvs. 3 ft. long: lfts. about 80 pairs, long-linear, acuminate, revolute, parallel-nerved; foliage pubescent. Probably not offered.

MICROGLÓSSA (*small tongue*, because the ligules are short). *Compositæ*. Nine or 10 Asiatic and African shrubs, sometimes climbing, allied to *Erigeron* and *Aster*, very little grown: lvs. mostly entire and alternate; fls. in small corymbose or paniced heads with very small white or bluish rays; ray-fls. in 1 to many series, pistillate and fertile; disk-fls. perfect and fertile, with 3-4-toothed dilated limb; involucre of many-rowed narrow bracts, the outer shorter; receptacle flat, nearly or quite naked; achene angled, bearing copious slender pappus-hairs. *M. albescens*, Clarke (*Aster albescens*, Wall.), occurs in horticultural literature: erect, with faintly grooved branches; lvs. lanceolate, entire or slightly serrate, hoary beneath; heads ½ in. diam., with bluish or whitish ligules. Temperate Himalaya. R.H. 1907, p. 523.

MICROKÉNTIA (*small* or *minute Kentia*). *Palmaçæ*. Here may belong the plant known to the trade as *Kentia gracilis*. *Microkentia* is a genus of 6 species of palms from New Caledonia. They are unarmed, with slender bamboo-like ringed trunks. The lvs. are terminal, pinnatisect, and the lf-segms. are long-sword-shaped and distinct, or the upper ones grown together into a broad 2-cut blade. The frs. in this genus are amongst the smallest in the palm family. The fls. also are minute. The true *kentias*, of which perhaps none is cult., have larger fls. and frs., the former white, the latter vermilion. The anthers are fixed at the base in *Kentia*, but dorsifixed and versatile in *Microkentia*. *Microkentia* is nearer *Clinostigma* and *Cyphosperma*, but in these the lf-segms. are irregularly cut off at the apex. *Kentia gracilis*, Brongn. & Gris. = *Microkentia gracilis*, Benth. & Hook. It is possible that the *Kentia gracilis* of the trade is *Kentiopsis divaricata*. None of the other species is known in cult. N. TAYLOR.†

MICROLÉPIA (Greek, *a small scale*; alluding to the indusium). *Polypodiaceæ*. A genus of graceful greenhouse ferns, allied to *Davallia*, but having the shallow, half-cup-shaped, membranous indusium attached to the sides as well as the base; the stalks are also continuous with the rootstock, and not joined to them, as in the true *davallias*.—Twenty or more species are known. For cult., see *Davallia*.

A. *Lvs. once-pinnate*.

margināta, C. Chr. (*M. marginālis*, Baker. *M. scabra*, Hort.). Rootstock creeping; lvs. 18–24 in. long, 9–15 in. wide, with linear pinnae, which are cut about half-way to the rachis into bluntish, oblong lobes. Ceylon to China.

AA. *Lvs. tri-quadrupinnatifid*.

platyphylla, J. Smith. Rootstock stout, scaly; lvs. 3–4 ft. long, on stout stalks, tripinnatifid; ultimate divisions broad, bluntish, toothed, oblong, deltoid; sori 2–12 to a segm., 1 in each tooth. India to Japan.

hírta, Presl. Lvs. 3–6 ft. long, on stout stalks, tri-quadrupinnatifid; ultimate divisions oblong, broadly toothed; rachises hairy or pubescent; sori 2–20 to a segm., 1 or more together at the base of each tooth. India and Polynesia. Var. **crístāta** is also offered by the trade. F. 1878, p. 59. Gn. 31, p. 428. F.R. 1:769.

L. M. UNDERWOOD.

MICROLÔMA (*small fringe*, referring to the hairs in the corolla-tube). *Asclepiadaceæ*. Slender-stemmed twining perennials, or sometimes dwarf little shrubs, little known in cult.: lvs. small, opposite; fls. mostly pink or red, in small subaxillary umbel-form cymes: 10 species in S. Afr. *M. tenuifolium*, Schum., has a cluster of stout fleshy roots, partially herbaceous, glabrous st., linear revolute lvs., urn-shaped somewhat fleshy carmine-red corollas with tube $2\frac{1}{2}$ in. long. B.M. 8248.

MICROMÈLES: *Sorbus*.

MICROMÈLUM (from the Greek for *small and apple*). *Rutaceæ*. Small spineless trees or shrubs distantly related to *Citrus*, of interest for breeding experiments and trial as stocks.

Leaves odd-pinnate; lfts. 3–9, alternate, ovate or obtusely acuminate; inf. a many-fl. terminal cyme or corymb; fls. 4–5-parted; fr. small, like a large pea, 5-celled with 1–2 ovules in each cell. The genus ranges from Indo-China throughout India and the Malay Archipelago, and includes several species. They should be intro. into the U. S. for trial in breeding experiments.

WALTER T. SWINGLE.

MICROMÉRIA (*small part*; small-flowered). *Labiātæ*. Small more or less trailing or decumbent perennial herbs and subshrubs, sometimes planted in borders and rock-gardens.

Leaves usually small, entire or toothed; whorls axillary or in terminal spikes; fls. small; calyx tubular and mostly 13-nerved, 5-toothed, somewhat 2-lipped; corolla 2-lipped, upper lip erect, flattish, entire or notched, lower spreading, 3-lobed; stamens 4, didynamous; style 2-parted at apex; nutlets smooth, ovoid or oblong.—Species 60 or more in northern extra-tropical countries, particularly in the Medit. region. By some authorities, the genus is included in *Satureia*. Of simple cultural requirements. Prop. by division as well as by seeds.

A. *Fls. few in the axils*.

Chamissônis, Greene (*M. Douglasi*, Benth. *Thymus Chamissônis*, Benth.). YERBA BUENA. Perennial; sts. long, slender, trailing and creeping, with sweet-scented round or oval lvs., 1 in. or less across; fls. purplish, mostly solitary in the axils, on long 2-bracted pedicels.

Woodlands, from Vancouver Isl. to S. Calif.—Sandy soil. Roots by stolons.

Piperella, Benth. (*Thymus Piperella*, All.). Fig. 2371. A few inches high, with slender arching branches; lvs. ovate, more or less cordate, sessile; fls. purple-and-white in few-fl. lax peduncled secund fascicles; corolla lightly pubescent. S. Eu.—A partially shrubby rock-garden plant; prop. by cuttings.

AA. *Fls. numerous in the axils*.

rupéstris, Benth. A dense, low-growing perennial, woody at the base, with prostrate sts., which turn up at the extremities, giving a heath-like effect when in bloom; lvs. with the odor and taste of pennyroyal; fls. abundant, small, white, with lavender spots on the inner side of corolla-lobes, borne for several inches along the sts. S. Eu.—



2371. *Micromeria Piperella*.
(Flower $\times \frac{1}{2}$)

Prop. from cuttings and seeds. It blooms from July until heavy frosts, and proves very satisfactory for rockery and informal border.

L. H. B.†

MICROPHÈNIX (*small Phoenix*). *Palmaceæ*. A name applied to two hybrid palms that were described some thirty years ago. *M. decipiens*, Naudin, is a hybrid between *Phoenix dactylifera* and *Chamærops humilis*; and *M. Sahitii*, Carr., between the foregoing (*M. decipiens*) and *Trachycarpus excelsus*, with the violet-colored petioles and fruit of the latter parent. R.H. 1885, p. 513.

MICROSPÉRMA: *Eucnide*.

MICRÓSTYLIS (Greek, *small style*). Syn., *Achroanthus*. *Orchidaceæ*. Mostly terrestrial orchids, sometimes grown under glass, and the hardy kinds perhaps transplanted to the bog-garden; some of the exotic species have colored foliage.

Deciduous, low plants, with fleshy roots, solid bulbs, or some of the kinds with pseudobulbs; lvs. plicate or membranaceous (in some species only 1); fls. mostly small, usually greenish or yellowish but often oddly shaped, in a terminal raceme, spike or umbel, with small and narrow bracts; sepals free, spreading and nearly equal; petals about the length of the sepals but very narrow or even filiform; lip sessile and erect or spreading, shorter than petals but often very broad, entire or fimbriate or 2–3-lobed, cordate or ovate or auricled at base; pollinia 4, in pairs; fr. a small ovoid beakless caps.—Species more than 100, in many parts of the world, largely in the North Temperate Zone and some of them tropical; a few species occur in the U. S. and Canada. None of the species seems to be regularly in the American trade, but a few are offered abroad by orchid specialists.

The species of *microstylis* are deciduous orchids. They grow well in the warm end of the cattleya department, or better still treated like thunias or calanthes,—a rather warm moist atmosphere when growing in spring, reducing the same toward late summer as they begin to lose their foliage, and eventually resting them quite dry in a temperature of about 60° F. during winter. They will probably suffer in a Wardian case or bell-glass. They certainly will after growth is completed, if not at all times. (Robert M. Grey.)

M. calophylla, Reichb. f. 9 in.; fls. yellowish; lvs. ovate, undulate, spotted green, greenish brown in center and the margin gray-green; pseudobulb conical. Malaya.—*M. congesta*, Reichb. f. (*M. Bernaysii*, F. Muell. *M. fusca*, Reichb. f.). One foot; fls. greenish yellow, in a dense cylindrical raceme or spike; lvs. green.

Trop. Asia.—*M. discolor*, Lindl. 9 in.; fls. handsome but very small, yellow, shading to orange, on upright stalks; lvs. red-purple, bordered green. Ceylon. B.M. 5403.—*M. Josephiana*, Reicheb. f. 1 ft.; fls. yellow, rather large, in a raceme; lvs. broad-ovate, bronze, light green below; pseudobulbs oblong. India. B.M. 6325.—*M. macrochila*, Rolfe. 15 in.; fls. rather large, the sepals and petals yellow and lip red-purple and veined; lvs. mottled with light brown and cream. Farther India.—*M. metallica*, Reicheb. f. 9 in.; fls. rose-purple, with sepals marked yellow; lvs. oblong, acute, dark glossy purple with metallic sheen, light rose underneath; pseudobulbs cylindrical. Borneo.—*M. philippinensis*, Kränzl. Fls. yellow or purplish, sometimes as many as 100 in a spike 8 in. or more long; lip orbicular, deeply cordate at base; lvs. broad-oblong, somewhat undulate, bright green. Philippines.—*M. purpurea*, Lindl. 9 in.; fls. yellow-purple; lvs. dark metallic crimson above and red-gray beneath. Ceylon.—*M. Scottii*, Hook. f. 6 in.; fls. yellow; lvs. light green and cream-colored, on the margin and along the rib mottled light brown. Farther India. B.M. 7268.—*M. Wallichii*, Lindl. (*M. biloba*, Lindl.). 9 in.; fls. green-yellow to purplish; lvs. green, more or less shaded purple. Burma.

L. II. B.

MIGNONETTE (*Reseda odorata*) is a branching, annual herb from northern Africa, which at first grows upright, but later becomes more or less decumbent and wide-spreading. The leaves are simple. The fragrant small yellow-and-white flowers are borne on spicate racemes which vary in size with different strains of seed. (Fig. 2372.)

Although mignonette has been grown under glass for many years, it is only recently that growers have specialized with this crop for winter forcing. Careful selection of seed has resulted in greatly improved strains. Formerly the mignonette spikes were scattered and comparatively small; now large spikes of dense flowers are being produced. The sprays are very pleasing when arranged with carnations or other flowers having scanty foliage. The fragrance of the flowers adds to their popularity. The demand for mignonette has so increased the importance of the crop commercially that many florists are specializing in its cultivation.

Mignonette will grow in almost any soil, but the large growers prefer a medium light turfy loam. Pasture sod is excellent, and sod from a field which has been in grass for a considerable time is also good. William Nicholson of Framingham, Massachusetts, has been exceptionally successful in growing mignonette, and from his cultural notes have been compiled the following directions:

In growing good mignonette, a well-prepared soil is of prime importance. The same kind of soil is used as for carnations, and is prepared by first plowing the sod-land after the grass has been cut, usually about the first of August. After plowing, the wheel-harrow is used, and then rye and Canadian white field peas are sown. The last of October or the first of November, a heavy top-dressing of cow- or horse-manure is applied. Cow-manure is preferable. This is plowed under and left until spring. As soon as it is possible to work the ground, the land is wheel-harrowed several times, and an application of manure is made. The soil is plowed again, well disked, and bone-meal applied, about one ton to the acre; the land is then ridged, and is ready for the benches. This method of preparation eliminates much hand work, and there is little danger of the soil becoming sour, as it frequently does if the compost method is practised.

Most growers prefer to grow mignonette in raised benches about 5 inches deep. An inch of well-rotted stable-manure is placed on the bottom of the bench, and the remainder is filled with the composted loam.

The surface of the soil is leveled carefully, and marked off in rows 6 by 8 inches apart. From six to ten seeds are dropped at the intersection of each row, and covered very lightly. A light watering with a fine sprinkler is then given the soil, to settle it around the seeds.

Three sowings of seed are made each year,—in the first weeks of July, August, and September. Plants of the last sowing flower until the next July. After the seeds have germinated, and the seedlings have developed the third leaf, three strong plants are selected

and the others removed. Seed for next season's crop is selected from the plants started in September. The plants which produce good foliage and compact flower-spikes, with large individual flowers, are selected as the seed-bearing parents.

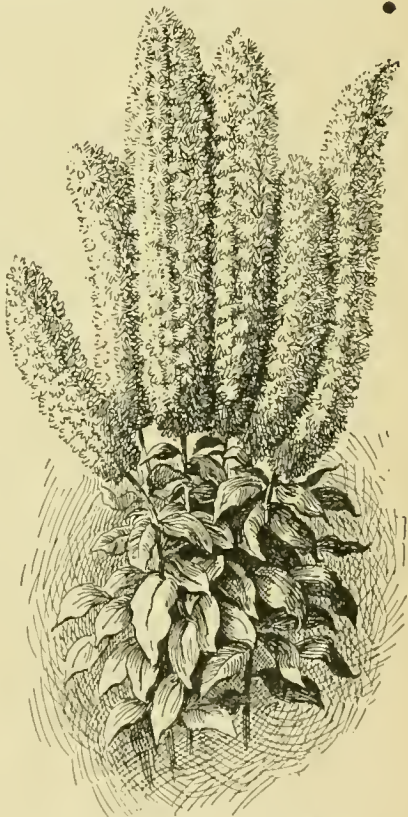
Great care should be taken that the seedlings started in July receive sufficient air. The ventilators should be kept open day and night to keep the plants stocky and short-jointed. During bright weather, temporary shading is necessary in the middle of the day, until the seedlings get their second leaf, then full sunlight should be given. After the flower-spikes begin to appear, all side shoots should be removed from around the top of the stem. Three or four strong bottom side shoots are left for a second crop. In this way a succession of blooms may be obtained throughout the winter. As soon as the plants are well developed, a wire ring is placed about each plant. Later, wires with cross strings are used for supports, the same as are used for carnations.

Mignonette is injured by over-watering, and great care should be taken that the soil be not too wet, especially when the plants are just started. As they develop, watering should be done only on bright mornings, for if water remains long on the foliage, the leaves become spotted.

A night temperature of 45° to 48° best suits mignonette. On cloudy days the temperature should be kept at 55°, and on bright days it should never be allowed to go above 65°.

When the plants have developed sufficiently so that flower-spikes are forming, they will require additional food. It is composed of one part sheep-manure and two parts of loam. The two are thoroughly mixed and three large handfuls of the mixture are scattered about the plants in a row across a 3-foot bench. Instead of this top-dressing, they may be given a weak solution of liquid manure. A bushel of sheep-manure is put into a bag and suspended in a barrel of water for two or three days. The bag is then removed, and the plants watered with the liquid.

Mignonette is grown in pots to a limited extent. There is some demand for it at Christmas and Easter, and some florists always have pot-plants in stock. It is more difficult to grow in pots than in beds, as it is necessary to have compact, stocky plants. This requires a great deal of care. The best method of culture is to fill 2½-inch pots with finely sifted soil, which has been



2372. Mignonette, Allen's Defiance.

prepared the same as described for bench culture, and to sow the seed in this soil. It should be remembered that the mignonette will not transplant; therefore, the seeds should be sown exactly where the plants are to grow. Several seeds should be sown in each pot to insure a perfect germination, and after this has taken place and the plants are well developed, all but one plant should be removed. The young plants should be kept as near the glass as possible to foster a stocky growth. Great care should be taken not to let the plants dry out, neither should they be over-watered.

As soon as the soil is filled with the feeding-roots, the plants should be re-potted, and this re-potting should be done frequently, the plants never being allowed to become pot-bound. When the plants are from 4 to 5 inches tall, they should be pinched, and the side shoots allowed to develop. When they have grown to a height of 6 or 7 inches, they should be staked and tied, and again pinched back to encourage branching. The large flower-spikes are not desired in pot-grown plants, but a larger number of smaller spikes. Pinching makes the plants much more symmetrical. When the plants are in flower, they should be in 7- or 8-inch pots.

As a garden flower, the mignonette is by no means showy, but its delicate fragrance makes it popular. It requires a cool well-drained soil, and one which is moderately rich in decayed organic matter. It does not like the full sunlight, so should be given a spot which is shaded a part of the day. The seed should be sown late in April, in the North, and a second sowing may be made early in July, so that the season of bloom be extended until the time of severe frosts.

E. A. WHITE.

MIKÀNIA (Prof. J. G. Mikan, of Prague, or his son and successor, J. C. Mikan, who collected in Brazil). Syn., *Willughbæya*. *Compósitæ*. Shrubs or herbs, the latter twining, rarely erect.

Leaves opposite, usually stalked; heads spicate, racemose, corymbose or panicle; fls. mostly white or pinkish.—About 150 species, mostly found in the warmer parts of Amer. Nearest to *Eupatorium*, but the latter has an indefinite number of involueral bracts instead of 4, and contains erect plants. This includes *M. scandens*, the climbing hempweed, a common native weed, but a pretty one.

scandens, Willd. CLIMBING HEMPWEED. Foliage distinct, the lvs. being somewhat heart-shaped or halberd-shaped, and long-acuminate; fls. very small, numerous, pinkish, and borne in dense clusters 1-2 in. across; these clusters, as in all the species, are composed of many small heads, each containing 4 fls., surrounded by an involucre of 4 bracts. Moist ground, New England to Fla. and Texas.—Very rarely offered by dealers in native plants.

Sánderi, Hort. Hothouse climber, with variegated foliage. Intro. 1899 by Sander & Co., who say the lvs. are richly embellished with dark velvet-purple patches; veins of mature lvs. white. The lvs. are about 6 in. long, 5 in. wide, boldly toothed. The botanical affinities of this plant are uncertain.

N. TAYLOR.†

MILDEW is the name given to a group of fungous diseases which attack leaves, shoots, flowers and fruits. The true or powdery mildews (*Erysiphaceæ*) appear as a thin white powdery coating on the surface of the plants. The disease is usually accompanied by distortion and dwarfing, and often death of the affected parts. In some cases, however, as in the maple mildew, the affected areas of the leaves retain their chlorophyll and remain green in the autumn long after the remainder of the leaf is dead and yellow. The mycelium is always superficial, forming spots or more or less extended areas on the affected organs. The injury is done by numerous haustoria, which penetrate the cells of the host and absorb nutriment for the mycelium,

and also serve as organs of attachment. During the summer mildews are propagated by 1-celled spores, many of which are cut off in succession from erect simple branches all over the diseased surface. Other spores, by means of which the fungus passes through the winter, are produced in sacs enclosed within hollow spherical receptacles, called perithecia. These appear as minute black or dark brown specks over the diseased area. They are produced in the autumn, and remain on the fallen leaves; but the spores within them do not ripen until the following spring, when they are liberated by the decay of the perithecia.

In the United States, considerable injury is caused by the following species: The rose mildew, *Spharotheca pannosa*, on roses under glass; *Erysiphe graminis* on wheat and other grasses; the vine mildew, *Uncinula spiralis*, producing the powdery mildew of grapes; *Podosphaera Orycanthæ* on apples and pears; and *Spharotheca Castagnei*, the hop mildew. The most successful mode of combating the mildews is by dusting with sulfur or spraying with bordeaux mixture. Either of these fungicides kills the mycelium and spores of the fungus.

The downy mildews or false mildews belong to the *Peronosporaceæ*, a group of fungi widely separated from the true mildews. The mycelium is parasitic within the tissues of the host, only the fruiting branches appearing at the surface. The fruiting branches have a characteristic form and method of ramification for each genus of the group. The spores, when they lodge on new host-plants, either produce an infecting thread directly, or, in most cases, the content of the spore is discharged in the form of swarm-spores, which swim about for a time and finally come to rest and produce the infecting mycelium. Resting-spores are produced sexually in this group within the tissues of the host.

This family contains about ten genera, of which the following are most commonly known: *Phytophthora infestans*, the potato blight; *Plasmopara viticola*, the downy mildew of grapes; *Bremia lactuæ*, often causing great damage to lettuce in forcing-houses; *Pythium Debaryanum*, causing damping-off of seedling cucumbers and various other seedling plants; and *Cystopus candidus*, the common white rust of crucifers. Modes of combating these diseases are set forth for each specific case in the experiment station literature of the various states. See, also, *Diseases and Insects*.

HEINRICH HASSELBRING.

MÍLIUM (ancient Latin name of broom-corn millet which, however, belongs to a different genus). *Graminææ*. MILLET-GRASS. Spikelets 1-fl., in diffuse panicles; glumes awnless, the lemma and palea coriaceous, as in *Panicum*.—Contains 5 or 6 species distributed through Temp. Eu. and Asia, one of which, *M. effusum*, also found in N. Amer., is occasionally cult. for ornament.

effusum, Linn. A smooth woodland perennial, 3-6 ft. high: lvs. broad and thin; panicle 6-9 in. long, with slender drooping branches. Dept. Agric., Div. Agrost. 7:104.

A. S. HITCHCOCK.

MILK PEA: *Galactia*.

MILK VETCH: *Astragalus*.

MILKWEED: *Asclepias*.

MILKWORT: *Polygala*.

MÍLLA (J. Milla was head gardener at the Court of Madrid). *Liliacææ*. An attractive spring-flowering bulb.

Leaves few, very narrow, grass-like, radical; scape low, simple and leafless, bearing 1 to several fls. in a terminal umbel; perianth salverform with 3-nerved segms. which are separate nearly to the base; stamens 6, nearly sessile in one row; caps. sessile, oblong-obovate. Bentham & Hooker, as well as Engler, restrict the genus

Milla (as Cavanilles, its author, intended) to one Mexican species. From Brodiaea the genus differs in the fact that the pedicels are not jointed and the perianth-segments are always 3-nerved. Milla and Brodiaea are native to the northern half of the western hemisphere. In S. Amer. is the genus *Triteleia*, which is by some referred to Milla, by others to Brodiaea, and by still others kept distinct. There is one *Triteleia* (*T. uniflora*) in common cult. In his monograph (Journ. Linn. Soc. 11, p. 378), Baker refers the triteleias to Milla, and this disposition is followed by Index Kewensis, but in a later account (G.C. III. 20, p. 459) he refers them to Brodiaea. Watson (Proc. Amer. Acad. Arts & Sci. 9, p. 240) restricts Milla to one species. The N. American plants which have been referred to *Triteleia* are perhaps best treated as brodiaeas, and they are so considered in the account of that genus in Vol. I of this work (p. 576). The S. American triteleias are described under that genus in Vol. VI.

biflora, Cav. Scape 6-18 in. high from a small coated bulb, bearing 1-5 (usually 2) star-like, waxy white, fragrant fls. 2-2½ in. across, with oblong-lanceolate segms.: lvs. rough, nearly terete. S. Ariz. and New Mex. to Cent. Mex. B.R. 1555. F.S. 14:1459. Gn. 24, p. 155. J.H. III. 55:133. G. 6:271.—One of the best of the small bulbs. It is known as Mexican star, Mexican star of Bethlehem, frost flower, and floating star. The fls. are of a charming waxy consistence, and are borne on long sts. They are excellent for cutting, and last several days. Planted in the border early in spring, they soon throw up their fls. and lvs. They should be allowed to remain until Sept. or Oct., when they may be taken up and stored for the winter. Our gardeners know milla mostly as a pot bulb for flowering under glass late in winter or early in spring. It blooms readily in the conditions given to freesias. Several bulbs should be placed in a pot, although a number of stalks will spring from one bulb. The plant is little offered by dealers.

L. H. B.

MILLER, DUSTY: *Lychnis Coronaria*; also *Senecio artemisia*.

MILLETS are important agricultural grasses. The true millet or Broom-corn millet of Europe is *Panicum miliaceum*. The common millets of the United States, the Foxtail millets, are forms of *Setaria italica*. African millet, also called Black, Chinese, Indian, and improperly Pearl millet, is *Holcus Sorghum*. The name African millet is sometimes applied to *Eleusine Coracana*. Barnyard or Japanese millet is *Echinochloa frumentacea*. Pearl millet is *Pennisetum americanum*. Dept. Agric., Farmer's Bull. No. 101 is devoted to foxtail millets.

A. S. HITCHCOCK.

MILLÉTTIA (named in honor of Dr. J. A. Millett, botanist, and who wrote on China in 1726). *Leguminosae*. About 100 or so species of Old World tropical trees and large shrubs, usually climbers; differs from the Japanese and N. American genus *Wistaria* in the hard usually flat and thick pod not opening so readily: lvs. large, odd-pinnate; flts. opposite, stipellate: fls. showy, in axillary racemes often fasciated, simple or paniculate and terminal, white, purple or reddish.—Although an abundant genus in Trop. Afr. and the far E., it has yielded little for American horticulture.

A. Fls. purple.

cáffra, Meissn. IRONWOOD. A S. African tree, 20-30 ft. high, with very hard close-grained brown wood and dark, rough, rugulose bark: lvs. on channeled petioles 6-8 in. long; flts. lanceolate-oblong, acute, in 5-6 pairs, 2-2½ in. long, 1 in. apart; slender stipules 2-3 lines long; panicle 6-8 in. long; fr. leathery, velvety, used as a medicine by the Kafirs. Intro. into Fla. in 1891.

AA. Fls. white.

japonica, Gray. A Japanese woody climber: lvs. light green, odd-pinnate; flts. narrowly ovate, 4-6 pairs, 1½ in. long, 1 in. apart: racemes simple, nodding, 5-8 in. long. Probably not hardy in the N. Has been offered by dealers in Japanese plants. S.Z. I: 43 (*Wistaria japonica*).—At the Arnold Arboretum (Boston) it kills to ground but comes up in spring, not blooming; on Long Island, it blooms and even fruits.

L. H. B.

MILTÔNIA (named for Lord Fitzwilliam, Viscount Milton, a patron of horticulture). *Orchidaceae*. Some of the most beautiful orchids in cultivation, with pseudobulbs closely clustered and sheathed with long graceful dark green leaves, forming plants over 1 foot in diameter, bearing numerous large flowers.

Herbs, with short pseudobulbs, bearing 1-2 lvs. at the summit and few or many sheathing lvs. at the base: the infl. arises from the base of the pseudobulbs, and consists of a single-fl'd. peduncle or of a loose raceme of long-pedicelled fls.; sepals sub-equal, spreading, free or the lateral ones slightly united; petals similar or a little wider; labellum not distinctly clawed, large, expanded, not 3-lobed, but often bifid at the apex; both the segms. and the labellum are expanded, forming a flat fl.; column short.—About 20 species, mostly from Brazil. *M. Roezlii*, *M. vexillaria*, and some closely related kinds were until recently known in gardens as odontoglossums. In the group containing the "true" miltonias, the pseudobulbs are separated from each other on the rhizome, and bear 1-2 yellowish green lvs. at the summit and few sheathing lvs. of the same color at the base. The fls. of nearly all miltonias remain on the plants in a fresh condition for a month or more. The leading species run into many horticultural forms listed under Latin names.

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KEY TO THE SPECIES.

- A. Pseudobulbs crowded, with numerous dark or gray-green sheathing lvs. at the base.
 - B. Labellum sagittate at the base 1. Roëzlii
 - 2. vexillaria
- BB. Labellum not sagittate, constricted in middle, (broadly panduriform) 3. Endresii
- 4. Phalenopsis
- AA. Pseudobulbs situated at intervals on the rhizome, with few yellowish green lvs.
 - B. Segms. of perianth broad, ovate to oblong.
 - C. Perianth uniformly colored white, rose or purple 5. spectabilis
 - 6. Regnellii
 - CC. Perianth variegated, yellow and brown or brown and green.
 - D. Labellum fidd'e-shaped 7. Clowesii
 - DD. Labellum broadly obovate 8. candida
 - 9. cuneata
 - DDD. Labellum oblong 10. Warszewiczii
 - 11. Russelliana
 - 12. flavescens
- BB. Segms. of perianth linear-lanceolate.

1. Roëzlii, Nichols. (*Odontoglossum Roëzlii*, Reichb. f.). Pseudobulbs narrowly ovate, 1-2 in. long: lvs. numerous, slender, 8-12 in. long, narrowly linear-lanceolate: scapes about half as long as the lvs., bearing 2-3 large fls.; fls. flat, 3-3½ in. across, pure white, with a purple band at the base of the petals and a yellow stain, more or less marked with reddish brown

at the base of the labellum; sepals and petals ovate-oblong, acute; labellum large, broadly obovate, with a tooth in the sinus, and a spur-like horn projecting backward on each side of the column. Closely allied to *M. vexillaria*, from which it differs in color and by the more slender, nerved lvs. Flowers twice a year in winter and spring. Colombia. B.M. 6085. I.H. 23:228. R.H. 1875:450. Gn. I, p. 251; 10:106; 26:232. G.C. III. 32:135. Var. *álba*, Hort. (*Odontoglossum Roëtzii* var. *album*). Fls. large, lacking the purple band on the petals. Gn. 26:232. F.M. 1875:161. A.F. 13:1453. Gng. 6:327.

2. *vexillaria*, Nichols. (*Odontoglossum vexillarium*, Reichb. f.). Fig. 2373. Pseudobulbs $1\frac{1}{2}$ –2 in. long: lvs. 6–12 in. long, narrowly elliptic-lanceolate; scapes sometimes 6 from a single pseudobulb, slender, and longer than the lvs., 3–4-flld.; fls. the largest of the genus, flat, about 4 in. long; sepals and petals ovate-oblong or obovate, pale or dark rose, sometimes with white margins; labellum large, rounded, deeply emarginate, narrowed to a sagittate claw, deep rose, whitish at the base, streaked with yellow and red. The fls. are extremely variable in shape and color. Spring and early summer. Western slope of the Andes, Colombia. B.M. 6037. I.H. 20:113. F.S. 20:2058. R.H. 1876:390. Gn. 9, p. 577; 10, p. 108; 17:474; 35, p. 268; 45, p. 536. G.C. II. 26:145; III. 18:743; 19:755; 27: suppl. May 26; 42:406; 44: 184. J.H. III. 31:301. G.F. 8:195. G. M. 39:386. G.Z. 21, p. 241. V. 5:138. A.F. 13:121.—One of the most popular of all orchids. Var. *Cobbiana*, Hort. Sepals and petals light rose, passing into white margin; lip white with 3 basal small yellow lines. Vars. *gigantæa*, *grandiflora*, *picta*, *rôsea*, have been advertised under *Odontoglossum*. Many forms are mentioned and described in horticultural literature; for these, the reader should consult the lists of orchid specialists.

3. *Éndresii*, Nichols. (*Odontoglossum Warscewiczii*, Reichb. f.). Pseudobulbs small, tufted: lvs. numerous, distichous, elliptic-lanceolate, about 1 ft. long; scape as long as the lvs., inclined or drooping, 6–8-flld.; fls. 2–2½ in. diam., flat, white, with a yellow crest on the labellum and a rose-colored blotch at the base of each sepal; sepals broadly ovate; petals elliptic; labellum very broadly fiddle-shaped and 2-lobed. Feb. Costa Rica. B.M. 6163.

4. *Phalænopsis*, Nichols. (*Odontoglossum Phalænopsis*, Lind. & Reichb. f.). Pseudobulbs ovate, with grass-like lvs. 8–10 in. long at the base and apex; stalks 1–3-flld., shorter than the lvs.: fls. large, flat, white, with the labellum variegated and streaked with crimson; sepals 1 in. long, oblong, pointed; petals broader and rounded; labellum large, broadened and 2-lobed in front, constricted near the middle and expanded above into 2 rounded lobes. The pseudobulbs are clustered, forming clumps 1 ft. or more across, with numerous fls. mingled with the long, grass-like lvs. Spring and summer. Colombia. I.H. 3:109. Gn. 18, p. 447; 26, p. 232; 35, p. 269; 36, p. 315. G.C. II. 25:364. I.H. 28:

447 (var. *luxurians*, more vivid). Var. *álba*, Hort. Fls. pure white except yellow markings on lip.

5. *spectabilis*, Lindl. Rhizome creeping, with the pseudobulbs placed about 1 in. apart, with 2 lvs. at the apex and few sheathing lvs. at the base: lvs. linear-oblong, 4–12 in. long; scapes erect, sheathed, 6–8 in. long, bearing a single fl. about 4 in. diam.; sepals and petals oblong, obtuse, slightly wavy, white or cream-colored; labellum 2 in. long, very broad in front, pendent, somewhat undulate, rose-purple, with darker veins. Brazil. B.M. 4204. B.R. 1992. I.H. 6:216; 12:416 (var. *cereola*); 14:524 (var. *rosca*); 15:573 (var. *virginalis*). P.M. 7:97. F.C. 1:45 (*Macrochilus Fryanus*). R.B. 15:25. G.M. 38:642. A.F. 6:631.—The first miltonia intro. into cult. It blossoms in autumn, large plants bearing from 20–50 fls., all opening at once and lasting about a month. Var. *bicolor*, Hort. Fls. white, with a violet spot on the labellum. Large-flld. and vigorous. Aug. Var. *Moreliana*, Hort. (*M. Moreliana*, Hort.). This variety is very distinct in color. Sepals and petals deep purple; labellum of the same

color, veined and shaded with rose. In habit the plant is like the type in every detail. B.M. 4425 (as var. *purpureo-violacea*, Hook.). F.S. 10:1008. I. II. 2:71. Gn. 31:374 (habit poor). F.M. 1874: 143. G.M. 40:37. F. 1850, p. 123 (outline). A.F. 6:633.

6. *Régnellii*, Reichb. f. Like *M. candida* in habit and foliage: lvs. 1 in. broad; scapes erect, bearing several large fls. over 2 in. diam.; sepals and petals spreading, recurved at the apex, oblong, acute, white; labellum subpandurate, obtuse or emarginate, rose-purple, with deeper veins and 3 yellow keels at the base. Sept. Brazil. B.M. 5436. Var. *purpurea*, Pynaert. Sepals and petals tinted with rose, with white margins; labellum crimson, with a white crest. R.B. 17:253.

7. *Clówesii*, Lindl. Pseudobulbs ovate-oblong, leafy at the base

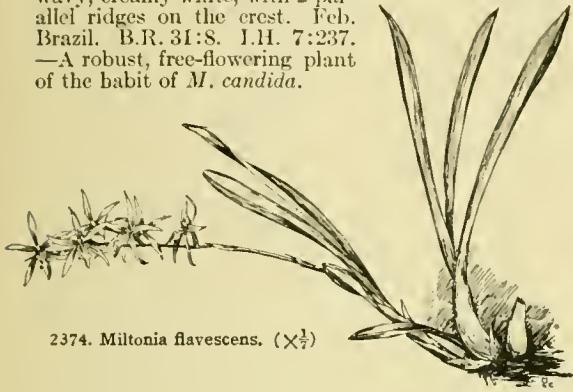
and bearing 2 narrow ensiform lvs. at the apex: scape erect, 1 ft. long, many-flld.; fls. 3 in. across, orange-yellow, mottled with brown, the lip white with a violet base; sepals and petals spreading, lanceolate, acuminate; labellum fiddle-shaped, with a cordate base and a broadly rotund, acute terminal portion. Resembles *M. candida*. Sept., Oct. Brazil. B.M. 4109. P.M. 9:241. Gt. 5:160. Var. *rosefieldiënsis*, Hort., has very large fls.

8. *candida*, Lindl. Pseudobulbs ovate-oblong, 2-lvd., with few lvs. at base: lvs. oblong-linear, 1 ft. long, 1½ in. broad; raceme erect, 1 ft. long, 6–8-flld.; sepals and petals spreading, oblong, acute, somewhat wavy, bright yellow, with large red-brown blotches; labellum large, broadly obovate, convolute, crenate and wavy on the margin, white, changing to yellow, with a faint purple blotch. Brazil. B.M. 3793 (var. *flavescens*). P.M. 6:241. Gn. 20, p. 463.—A strange species producing 5–6 racemes, each with 6–10 fls. about 2½ in. across. Autumn. Var. *superba*, Hort. Lip white, with a purple blotch.



2373. *Miltonia vexillaria*.

9. *cuneata*, Lindl. Pseudobulbs ovate, clustered, 4 in. long, sheathed with lvs. at the base and 2-lvd. at the apex: lvs. dark green, strap-shaped, 1 ft. long; scape erect, 5-8-fl., as long as the lvs.; fls. 3-4 in. across; sepals and petals lanceolate, spreading, mostly chocolate-brown, greenish yellow at the tips, and few spots of the same color; labellum obovate-rotund, slightly wavy, creamy white, with 2 parallel ridges on the crest. Feb. Brazil. B.R. 31:8. J.H. 7:237. —A robust, free-flowering plant of the habit of *M. candida*.



2374. *Miltonia flavescens*. ($\times \frac{1}{2}$)

10. *Warszewiczii*, Reichb. f. (*Odontoglossum Weldonii*, Hort. *Oncidium fuscatum*, Reichb. f. *Oncidium Weldonii*, Hort. *M. Weldonii*, Hort.). Pseudobulbs 3-5 in. long, much flattened: lvs. linear-oblong, obtuse, 5-6 in. long; fls. 2 in. long from the tips of the lip to that of the upper sepal, numerous, borne in a branched nodding panicle; sepals and petals cuneate-obovate, waved and crisped, pale reddish brown, with whitish tips; labellum oblong, fan-shaped, bifid, white, with a large rose-purple disk on the center of which is a large, brownish yellow blotch. March. Peru. B.M. 5843. F. S. 18:1831. Var. *leucochila*, Hort. Fls. pale purple; lower half of lip ruby-purple.

11. *Russelliana*, Lindl. (*Oncidium Russellianum*, Lindl.). Pseudobulbs ovate, ribbed, 2-lvd.: lvs. narrowly lanceolate: fl.-sts. dark purple, few-fl.: sepals and petals ovate-oblong, somewhat undulate, brownish purple with green margins; labellum oblong-cuneate, retuse, apiculate, violet, the crests or lamellae on the disk margined with white. Dec. Brazil. B.R. 1830. P.M. 7:217. —Fls. rather small and dull in color.

12. *flavescens*, Lindl. Fig. 2374. Pseudobulbs narrow: lvs. linear-ensiform: raceme many-fl., the stalk sheathed with bracts; fls. stellate, yellow, with the labellum somewhat spotted with purple; sepals and petals linear-lanceolate, acuminate; labellum pandurate, undulate-acuminate. June. Brazil. B.R. 1627 (as *Cyrtochilum flavescens*). Var. *grandiflora*, Regel. Fls. larger, white at first, becoming whitish yellow; labellum obtuse. Gt. 39:1328.

M. Berti = *M. Bleuana* $\times$ *M. vexillaria*. — *M. Bleuana*, Hort. (*Miltoniopsis Bleu*, Bleu) = *M. vexillaria* $\times$ *M. Roezlii*. In habit like *M. vexillaria*: fls. 3-4 in. across; sepals and petals white, the latter purple-stained at base; lip nearly orbicular, notched at apex, white veined with pink in front of the yellow disk. Intermediate between the parents. A.F. 6:631; 9:1087. G. F. 5:198, 199. J.H. 111. 68:277. O. 1913:104. — *M. Bleuana grandiflora*, a large-fl. form. G.M. 57:267. — *M. Bleuana Peetersii*, Hort. = *M. Bleuana* Peetersii $\times$ *M. Roezlii* $\times$ *M. vexillaria* (Leopoldii) $\times$ *M. Bleuana*. Sepals and petals rose-purple below, the color on the sepals lighter; lip with the yellow crest crimson-bordered, with a rose band in front. G.C. 111. 49:274. — *M. Bleuana Stevenii*, a dwarf variety with white fls. and lip crimson-striped. — *M. Blinzi Lubbersiana*, Reichb. f. Fls. about 4 in. across; sepals and petals light yellow, blotched and barred with brown; lip purple at base, lined red-brown, the nearly orbicular front lobe lighter. Supposed to be a natural hybrid between *M. spectabilis* $\times$ *M. Clowesii*. G. 29:563. — *M. Charlesworthii* = *M. vexillaria* "G. D. Owen" $\times$ *M. Hyana*. — *M. festiva* = *M. spectabilis* $\times$ *M. flavescens*, probably. — *M. Ifyana* = *M. Bleuana* $\times$ *M. vexillaria* var. Leopoldii. — *M. radiata*, Hort. "Fls. larger, white, shaded pur-

ple, and heavily blotched with purple and yellow." — *M. Robsonae* = *M. Roezlii* $\times$ *M. vexillaria* "Queen Alexandra." — *M. Rogersonii*, Hort. "Like a large pale *M. vexillaria*." — *M. Sander*, Hort. Fls. pale with a dark maroon eye. Hybrid between *M. St. Andre* $\times$ *M. vexillaria* "G. D. Owen." Gn. 77, p. 352. — *M. Schroederiana*, Hort. Raceme 7-9-fl.: fls. 2½ in. long, fragrant; sepals and petals brown, yellow-marked; petals falcate, turned toward dorsal sepal; lip pandurate, rose-purple at base, the apex white. Cent. Amer. R. 2:96. — *M. travassosiana*, Hort. Apparently a form of *M. Roezlii* with yellow sepals and petals.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

MILTONIÖDA. *Orchidaceae*. Bigeneric hybrids of *Miltonia* and *Cochlidia*. *M. Cooperi* is a garden hybrid between *Miltonia Warszewiczii* and *Cochlidia Noetzeliana*; fls. brick-red with lighter tip to labellum, in slender branched spikes. *M. Harwoodii* is a garden hybrid between *Miltonia vexillaria* and *Cochlidia Noetzeliana*. Fl. about 2 in. long, the sepals and broader petals bright cerise-rose; lip miltonia-like, cream-white freckled with rose. *M. Lindenii* is a garden hybrid probably of *Cochlidia vulcanica* and *Miltonia Phalænopsis*.

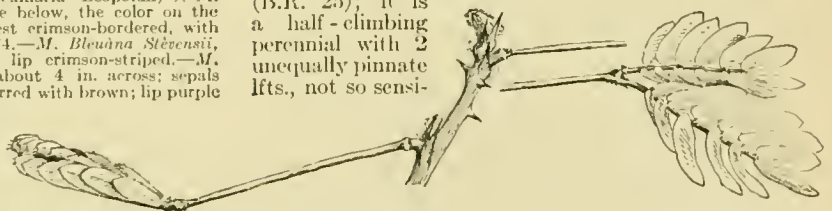
MILTONIÓPSIS. Garden hybrid, *M. Pauwelsiana*, between *Miltonia Roezlii* and *M. vexillaria* var. *Leopoldii*, recorded as distinct from other kinds.

MIMOSA (Greek, a mimic, alluding to the fact that the leaves of some species are sensitive). *Leguminosae*. Woody or herbaceous plants, mostly tropical, grown for the showy flowers or feathery foliage; of some species the leaves are sensitive. What the florists know as mimosas are acacias (chiefly *A. armata*).

Trees, shrubs or herbs of varying habit (sometimes woody climbers), mostly thorny or prickly, with bipinnate often sensitive lvs. (sometimes the lvs. reduced to phyllodia): fls. not papilionaceous, in close heads or head-like spikes, usually with 4 or 5 united petals, and a minute or obsolete calyx; stamens 4-10, exserted; pollen granular: pod flat, oblong or linear, breaking up into 1-seeded joints when ripe. *Mimosa* has stamens 10 or less (once or twice as many as the petals); *Acacia* has numerous stamens. — Of *Mimosas* there are probably 300 species, chiefly of Trop. Amer. A number of the bushy species, and the small trees, are planted more or less in warm countries for ornament. They require the treatment given the woody acacias.

A. Plant herbaceous or practically so in cult.

púdica, Linn. SENSITIVE PLANT. HUMBLE PLANT. Fig. 2375. Cult. as an annual, but probably perennial in the tropics, and somewhat shrubby, erect, branching, hairy and spiny: lvs. long-petioled, with 2 or 4 subdigitate pinnate linear-oblong lfts.: fls. many, in globular-oblong heads on elongating axillary peduncles, purplish: pods comprising 3 or 4 spiny joints. Brazil, but widely naturalized in warm countries; run wild in the Gulf States. G.W. 2, p. 18. — Easily grown from seeds, which are sold by seedsmen. The plant grows readily in any place in which garden beans will thrive. It is grown for its sensitive foliage. The movements are usually quickest in young plants. When the lvs. are touched, the petiole falls and the lfts. close. The utility and the origin of these movements are not well understood. *M. sensitiva*, Linn., is a distinct plant (B.R. 25); it is a half-climbing perennial with 2 unequally pinnate lfts., not so sensi-



2375. *Mimosa pudica*. — Sensitive plant. Normal position of the leaf is shown on the right, and the collapsed position on the left. ($\times \frac{1}{4}$)

tive as *M. pudica*. The word *pudica* is Latin for *modest* or *bashful*.

AA. *Plant distinctly woody: trees or bushes.*

a. *Primary pinnae 1 pair.*

Spigazzinii, Pirottæ. Bush, scandent and much branched, with recurved spines at base of petiole: lvs. sensitive, bipinnate: pinnae 2, from 2-3 in. long; lfts. or pinnules very numerous, sessile and close together, oblong or linear-oblong and acute, 3-nerved: fls. rose-purple, in globular peduncled heads $1\frac{1}{4}$ in. diam., the heads axillary or in a terminal raceme; corolla 4-lobed; filaments rose-red and anthers yellow: pod 1 in. long, linear. Argentina. B.M. 7899. G.W. 2, p. 19. —A good greenhouse shrub; intro. in S. Calif. Var. *glauca*, Hort., has glaucous foliage and whitish fls.

bb. *Primary pinnae 2 pairs.*

guayaquilensis, Steud. (*Acacia guayaquilensis*, Desf.). Pinnae 4, with 3-5 pairs of ovate-obtuse glaucous lfts., of which the lower ones are smaller; opposite stipular spines at the base of the lf. Ecuador.

albida, Humb. & Bonpl. Scandent, shrubby: branches cano-pubescent, spiny: pinnae 2, each with 4 lfts., the inner ones of the lower pair very small, the others oblong and very unequal at base and acute at apex; petioles unarmed: fl.-heads twin, pinkish: pod about 1 in. long, grayish pubescent. Mex. to Peru. L.B.C. 3:249 (as *M. sensitiva*). —Intro. in S. Calif.

bnn. *Primary pinnae 3-5 pairs.*

Ceratonia, Linn. (*Acacia Ceratonia*, Willd.). Scandent glabrous shrub, with recurved prickles on branches and petioles: pinnae about 5 pairs; lfts. obovate to roundish: pods glabrous, somewhat articulate and spiny, broadly oblong. W. Indies.

bbbb. *Primary pinnae mostly 6-8 pairs or more.*

acanthocarpa, Poir. (*Acacia acanthocarpa*, Willd. *A. brachyacantha*, Humb. & Bonpl.). Bush or small tree: pinnae 12-14, with 6-15 pairs of oblong-pubescent lfts.: stipular spines 2: fls. in heads on twin axillary peduncles: pod falcate, spiny. Mex.

Dénhardtii, Hort. Ornamental shrub, the lvs. said to be almost as sensitive as those of *M. pudica*: branches glabrous or minutely hairy, striate, usually bent at each thorn: lvs. hairy, the pinnae 12-14, the ultimate lfts. small ($\frac{1}{2}$ in. long) and crowded and falcate-oblong-acute: fls. in club-shaped, axillary clusters: thorns 1-3 in. long. S. Amer. —Intro. in S. Calif.

rubicaulis, Lam. Low tree, with many small hooked spines: pinnae 8-20, the rachis prickly; lfts. 12-24, thin, $\frac{1}{2}$ in. or less long: heads reddish but becoming lighter colored, about $\frac{1}{2}$ in. long, on short simple peduncles; corolla very small: pod strap-shaped and somewhat falcate, 3-4 in. long. India, Afghanistan. —Intro. in S. Calif.

M. argentea, Hort. Of climbing habit, suitable for greenhouse, said to be of the same section of the genus as *M. pudica*, slender, the sts. and branches hairy: pinnae 2 or 3 pairs; lfts. about 40, oblong pinkish on the under side (as are the young shoots), green at the tips and silver-gray on lower half. Brazil.

L. II. B.

MÍMULUS (Latin, a little mimic, from the grinning fls.). *Scrophulariaceae*. Mostly herbs (annual or perennial) with interesting irregular flowers in many colors, some of them border subjects and others flower-garden plants.

Low plants (sometimes shrubby), decumbent, ascending or erect, glabrous or pilose and often clammy: lvs. opposite, entire or toothed: fls. axillary, solitary or becoming racemose by the reduction of the upper lvs.; calyx 5-angled, with 5 short or long teeth; corolla-tube cylindrical, sometimes swollen at the throat; stamens 4, didynamous; caps. oblong or linear, loculicidally dehiscent. —Species probably 60 or 70, if *Diplacus*, *Eumanus* and *Mimulastrum* are included, mostly in extra-

Trop. Amer., but some in Asia, Austral. and Afr. The genus is specially rich in W. N. Amer. This genus includes the monkey-flower, *M. luteus*, and the musk-plant, *M. moschatus*. Monkey-flowers are something like snapdragons, although they do not have a closed throat. They are 2-lipped fls., with 2 upper and 3 lower lobes, which are all rounded and usually irregularly splashed and dotted with brown on a yellow ground. Though perennial, they are commonly treated as annuals and are considerably used for pot cult. in winter, as well as for summer bloom outdoors. The musk-plant is grown for its scented foliage and pale yellow fls. It is sometimes used in hanging-baskets, but the foliage is so sticky that it gathers too much dust. The kinds described below are all perennial at least by underground parts (except *M. brevipes*), and most of them are natives of wet and shady places in N. W. Amer. They mostly grow 1-3 ft. high and bloom all summer. *Diplacus* is here included in *Mimulus*.

Mimulus plants (*M. luteus*) can be increased by sowing seed from January to April in pans of light sandy soil. They like a mixture of loam, leaf-mold and sand in equal parts. They may be kept in a temperature of 60° until they show signs of coming up, when they should be placed in a house that stands at about 50° during the night. As soon as the seedlings can be handled, they should be potted off into small pots and grown along in as cool a house as possible. The early-sown plants can be planted out in May in a cool shady situation, where, if they can have enough water to keep the roots moist, they will bloom fairly well. Those that are sown late can be grown on by shifting into 2-, 3-, 4- and 5-inch pots, using a compost of fibrous loam three parts, well-decayed cow-manure one part, and enough sand to keep the compost open. In the summer these may be grown outside in frames covered by lath shading. Late in autumn they may be brought into a coolhouse with 45° to 50° night temperature. Give them a place near the glass, and with care as to watering and ventilating they will bloom satisfactorily. They can also be increased from cuttings taken in the early spring. —*M. moschatus* can be grown from seed and cuttings. They may be planted out in a partly shaded situation, where they will grow all summer. In the autumn, lift some of the clumps and pot them. These may be grown in a coolhouse of about 45° at night. In the spring, when it is desired to increase the stock, take pieces of the new growth and place them around the side of a 3-inch pot, using the compost mentioned above; by keeping moist and shaded for a short time, they will soon root into the mixture and be ready to grow on. These may be shifted into 4-inch pots and soon will make fine little plants by their rapidly ereeping growth. (J. J. M. Farrell.)

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A. *Fls. violet, purple or lilac.*

1. **ringens**, Linn. Herb with perennial rootstocks, branching, 1-3 ft. high, the sts. square: lvs. oblong or lanceolate, acute, serrate, clasping at base: fls. violet (varying to white), about 1 in. long, the throat very narrow; peduncle exceeding the calyx; calyx-teeth long and awl-shaped. Wet places, Nova Scotia to Man. and far S. B.M. 283. —A common and rather attractive native, useful for establishing and colonizing in wet places.

2. **alatus**, Soland. St. somewhat winged or angled: lvs. ovate to oblong, acute, dentate-serrate, petioled:

fls. violet; peduncle shorter than calyx; calyx-teeth short and broad, abruptly sharp-pointed. Wet places, W. New England to Kans., south to Texas. L.B.C. 5:410.

AA. Fls. yellow, brown or brick-red, often spotted.
n. Plant annual.

3. *brévipes*, Benth. Viscid-pubescent, 1-2 ft.: lvs. bright green, to 4 in. long, lanceolate to linear: fls. large (to 1½ in. long) clear canary-yellow, the limb broad and with rounded lobes; calyx-teeth acuminate, very unequal. Calif.—Seeds are now offered.

BB. Plant perennial, herbaceous.
c. Foliage not sticky or clammy.

4. *cùpreus*, Regel (*M. luteus* var. *cùpreus*, Hook. By Gray included in his var. *alpinus* of *M. luteus*). A Chilean species, differing from *M. luteus* in its tufted habit and the fls. yellow at first, finally becoming copper-colored, and the lobes possibly rounder and more nearly equal, the throat yellow, spotted brown. B.M. 5478. Gn. 24, p. 177. R.H. 1883, p. 284.—Perhaps not specifically distinct from the next.

5. *luteus*, -Linn. MONKEY-FLOWER. Fig. 2376. Glabrous, the larger forms 2-4 ft. high: lvs. parallel-veined, ovate to roundish to subcordate, sharply



2376. Forms of *Mimulus luteus*. (×½)

toothed, upper ones smaller, the lower sometimes lacinate: fls. deep yellow and commonly with dark spots within, the corolla 1-2 in. long; calyx ½ in. or less long, somewhat ventricose. Alaska to Chile. B.M. 1501.—Monkey-flowers nearly always have yellow throats with brown dots. The lobes are sometimes clear yellow. In var. *rivulàris*, Lindl., only 1 lobe has a large brown patch. B.R. 1030. L.B.C. 16:1575. In var. *Youngeana*, Hook., every lobe has such a patch. B.M. 3363. B.R. 1674 (as *M. Smithii*). In the common strains these patches are more or less broken up and the fls. mottled and dotted. F. 1863:73 (as *M. maculosus*). V. 10:289 (as *M. hybridus*). A very distinct set of colors is represented by var. *variegatus*, Hook., the throat chiefly white, but with 2 yellow longitudinal lines dotted with brown on the middle lobe of the lower lip; all the lobes bright crimson-purple, with a violet reverse. B.R. 1796. B.M. 3336. L.B.C. 19:1872. G. 29:335. Modified as described under var. *Youngeana*. R.H. 1851:261. F. 1850:137. The pictures

cited above bear various legends. The varietal names given above do not appear in the trade, the leading current names being *duplex* (hose-in-hose), *gloriosus*, *hybridus*, *hybridus tigrinus*, *hybridus tigrinus grandiflorus*, *quinquevulnerus maximus*, *pardinus*, *tigrinoides* and *tigrinus*. Some of these names are advertised as varieties, but all of them frequently appear as if they were species. For *M. hybridus cupreus*, Hort., see *M. cupreus*, No. 4. *M. Bärnetii*, Hort., is a garden hybrid between *M. luteus* and *M. cupreus*. G.C. 111. 30:107.

Var. *alpinus*, Gray (*M. Røzzlii*, Hort.). About 2-12 in. high, leafy to top: st. 1-4-fl.: corolla ¾-1¼ in. long.

cc. Foliage sticky or viscous.

6. *cardinalis*, Douglas. Villous, 2-4 ft. high: lvs. sharply toothed: fls. red and yellow, the upper lobes much grown together and reflexed, the whole limb remarkably oblique. Water-courses, Ore. and Calif. to Ariz. B.M. 3560. R.H. 1857, p. 137 (as *Diplacus*). Mn. 8:161. F. 1843:193.—Hardy in Mass., with slight winter covering. Blooms first year from seed.

7. *Lewisii*, Pursh. A more slender plant than No. 6, greener, and merely pubescent: lvs. minutely toothed: fls. rose-red or paler, the lobes all spreading. Shady, moist ground. Brit. Col. to Calif. and Utah. B.M. 3353 and B.R. 1591 (both as *M. roseus*).

8. *moschatus*, Douglas. MUSK-PLANT. Perennial, by creeping sts. 1-3 ft. long, villous and sticky, with a musky odor: lvs. oblong-ovate: fls. pale yellow, lightly dotted and splashed with brown, the corolla about ¾ in. long. Brit. Col. to Calif. and Utah. B.R. 1118.—This and *M. luteus* have a broad throat. The fls. are normally about ¾ in. across, but in F.M. 1877:248 (var. *Harrisonii*) they are 1½ in. across. Hardy, evergreen trailer for damp shady spots; good for planting under cool greenhouse benches.

BBB. Plant perennial, woody or shrubby (at least at base).

9. *glutinösus*, Wendl. (*Diplacus glutinösus*, Nutt.). Shrubby, 2-6 ft. high, nearly glabrous but sticky: lvs. narrow-oblong to linear, entire or denticulate, to 4 in. long, the margins at length revolute: fls. to 2 in. long, short-pedicelled, orange or salmon to pale buff, rather obscurely 2-lipped, the lobes toothed or notched. Rocky banks; common from San Francisco south. B.M. 354 (*M. aurantiacus*). G.W. 15, p. 649. A.G. 12:737. A.F. 12:1107.—A very variable species.

M. capensis, Hort., is listed abroad as fit for cool greenhouse or pot-plant, or for warm border: 3-4 in. high: fls. bright orange, Apr.-July. Said to resemble *M. cardinalis* in habit and infl.—*M. radicans* of the lists is probably *Mazus radicans* (*Mimulus radicans*, Hook. f.).

WILHELM MILLER.
L. H. B.†

MÍMUSOPS (Greek, *ape-like*, but application not obvious). Including *Imbricaria*, *Sapotaceae*. Tropical trees, with milky juice, some of them producing edible fruit, planted far South mostly for ornament.

Leaves thick and shining, simple and entire, alternate, with inconspicuous transverse veins: fls. perfect, gamopetalous, the corolla of 6 or more lobes, but bearing twice as many appendages in the sinuses, the calyx of 6 or 8 sepals in 2 rows; stamens usually 6-8, inserted on the base of the corolla; staminodia present: fr. a globose or ovoid, 1-6-seeded berry, sometimes edible.—Probably 60 species in the tropics of both hemispheres. The species are confused and the names in the trade may not represent the species as now accepted by botanists. For a recent account of the W. Indian species, consult Pierre & Urban in *Symbolæ Antillanae*, V (1904). The mimusops are fine evergreen trees, good for ornament in frostless countries, and yielding perfumery, oil, rubber and other products. The fls. are small, white, and usually borne in axillary fascicles. Some of the species become more than 100 ft.

high, and several of them yield hard and durable timber. A few species have been somewhat advertised in S. Calif. and S. Fla., but their cult. in this country is of small account. The sapodillo (which see) is a closely allied tree.

Kaūki, Linn. (*M. dissēta*, Hook. *M. Hookeri*, A. DC. *M. Bōjeri*, A. DC. *Kaukēnia Kaūki*, Kuntze). Tree, 20-35 ft., the young branches gummy, lightly pubescent; lvs. crowded at ends of branches, obovate-elliptic, or ovate, 4 in. long, long-petioled, obscurely nerved, silky-white beneath; fls. clustered on tomentose twin or solitary pedicels not exceeding the petiole; corolla $\frac{1}{2}$ in. long, with 18 narrow acute lobes or petals, the exterior narrower; calyx-lobes 6; staminodes 6-8, lobed or serrate; stamens 6-8; ovary 6-7-celled; berry about 4-seeded, to 1 in. diam., obovoid and smooth. Birma to Malaya. B.M. 3157. Cultivated in West Indies.

Balāta, Miq. (*Tchras Balāta*, Aubl. *M. bidentāta*, A. DC. *M. Pierreana*, Baill.). Tall tree, to 100 ft.: lvs. petioled, oblong-lanceolate, elliptic or oblong-obovate, acuminate or obtuse, about 4 in. long, grayish velutinous or nearly glabrous beneath, lightly very many-nerved; pedicels 10 or more, somewhat shorter than the petioles; calyx-lobes or sepals 6, grayish velutinous on the back; corolla-lobes 6 or 8 and more, the exterior ones 2-lobed or -parted and denticulate; stamens 6 or 8; staminodes lobed or denticulate; ovary 8-10-celled; berry ovoid, about 1 in. long. W. Indies and S.—It is a variable species, with a number of named botanical varieties in the W. Indies. The *M. globosa* of lists probably belongs here.

Cōmmersonii, Engler (*M. coriācea*, Miq. *Imbricaria coriācea*, A. DC.). Tree; lvs. oval-obovate, retuse, short-petioled, entire, shining above and slightly pilose beneath, coriaceous; pedicels solitary, or twin, axillary, much shorter than lvs.; outer calyx-lobes reddish pubescent outside but nearly glabrous inside, the inner ones narrower and white-velvety. Madagascar.—Said to be intro. in S. Calif.

parvifolia, Radlk. (*M. Sībēri*, Chapm., Gray, et al. *M. floridana*, Engler. *M. bahamēnsis*, Pierre. The *M. Sībēri*, A. DC., is a form of *M. Balata*). Wild Dulc. Becoming 35 ft. tall; lvs. elliptic to obovate, retuse, green, 2-4 in. long, slightly revolute, slender-petioled; corolla-segms. 6, oblong and exceeding the narrow appendages; fertile stamens 6; staminodia short-triangular, nearly entire; fr. nearly 1 in. diam., brownish or yellowish, maturing in autumn, said to be edible. Fla. Keys to Trinidad.

Elēngi, Linn. Tall tree (becoming 50 ft.): lvs. elliptic and short-acuminate (3-3½ in. long), rhomboid at the base, petiole $\frac{3}{4}$ in. long; corolla-lobes about 6, narrow-lanceolate; fertile stamens 8; staminodia pilose, acute, entire or nearly so; fr. 1 in. or less, ovoid, 1- or 2-seeded, yellow, edible. E. Indies.

dispar, N. E. Br. Smaller tree than *M. Elēngi*; lvs. small, cuneate-oblong-lanceolate, obtuse, rusty-tomentose when young, but become glabrous-green, the petiole $\frac{1}{2}$ in. or less long, and the blade $\frac{3}{4}$ -2 in. long; fls. 12-16, in umbels on the tips of the branches; sepals 6-8, in two series; petals 18-24, in three series, linear-lanceolate, yellow; stamens 6-8; staminodia lanceolate-acuminate channelled; fr. size of an olive, yellow. Natal.—Intro in S. Calif.

L. H. B.

MĪNA: *Quamoclit*.

MINKELĒRSIA (Dr. Minkeler, professor of physics in the University of Louvain). *Leguminosæ*. Creeping or twining herbs of very few species, in Mex. Hooker writes that "the genus is considered by Bentham to be little more than a section of *Phaseolus*, distinguished by its longer calyx-lobes, and the elongate petals." None of the species seems to be regularly in cult. The following has been recently described. *M. biflora*, Hemsl., has a tuberous root and long very slender twining sparsely hairy st.: lfts. 3, nearly equal, orbicular-ovate, obtuse; fls. 1½ in. long, pale red-purple, 2 on each axillary peduncle; pod linear and straight, containing very small seeds. Mex. B.M. 7819.

MINT: *Mentha*.

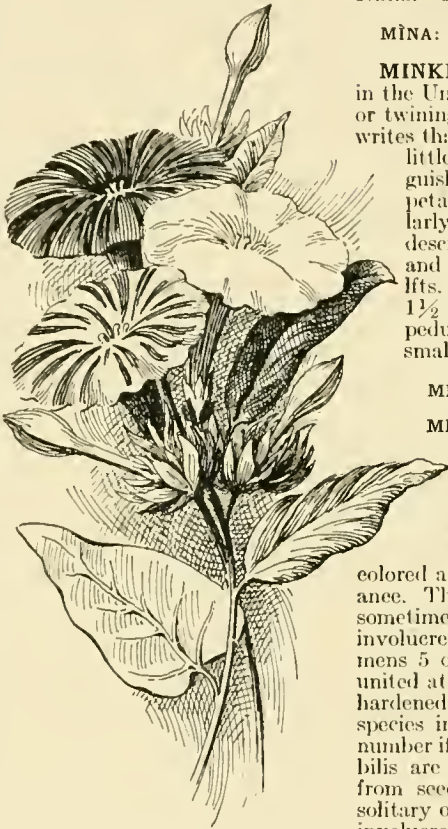
MINT GERANIUM: *Chrysanthemum Balsamita*.

MIRÁBILIS (The old name was *Admirabilis*, meaning wonderful, strange; shortened by Linnaeus to *Mirabilis*). *Nyctaginacæ*. Interesting flower-garden herbs.

The fls. have no corolla, but the calyx is colored and tubular and exactly like a corolla in appearance. The fls. are surrounded by a leafy involucre, and sometimes (as in *M. Jalapa*) only 1 fl. is borne in an involucre, simulating a corolla in a 5-cleft calyx; stamens 5 or 6, as long as the perianth, their filaments united at the base; style 1, with a capitate stigma; fr. hardened, caps.-like and indehiscent.—About a dozen species in the warmer parts of Amer.; or twice that number if *Oxybaphus* is included. The species of *Mirabilis* are perennial herbs, although grown as annuals from seeds, with lvs. petioled and opposite, and fls. solitary or paniculate and nearly or quite sessile in the involucre.

A. Involucre containing only 1 fl.: plant glabrous or very nearly so.

Jalāpa, Linn. **FOUR-O'CLOCK. MARVEL OF PERU.** Fig. 2377. Erect-bushy quick-growing herb, germinating readily from the large conical-oblong frs., 2-3 ft. high, bearing profusely in late summer and fall long-tubed funnel-form fls. in white and shades of red and yellow, and striped, opening in cloudy weather or late in the afternoon (whence the common name four-o'clock), and closing in the morning; lvs. ovate-lanceolate, short-petioled, acuminate, entire; fls. in clusters amongst the lvs.; stamens not exerted. Trop. Amer. B.M. 371. G. 2:499.—Cult. from early times, and always a favorite. In the tropics it has tuberous roots, and these were once supposed to be the source of jalap, whence the name *Jalapa*. There are dwarf and compact varieties; also forms with variegated foliage. The four o'clock is an "old-fashioned" fl. It is treated as a tender annual, thriving in any garden soil. It is a useful plant for growing in a hedge (plants 1 ft. apart) at the rear of the fl.-garden. Sometimes it comes up in the



2377. Four-O'clock.—*Mirabilis Jalapa*.

spring from self-sown seeds. Even as far north as New York, it often produces tuberous roots large enough to be lifted and stored like dahlias.

AA. *Involucre containing 1-3 fls.: plant viscid-pubescent.*
californica, Gray. Plant 1-3 ft. tall, the many sts. ascending from a somewhat woody base: lvs. thick or almost fleshy, ovate-oblong to round-ovate, short-stalked: involucre 5-cleft, short-peduncled, containing 1-3 rose-purple fls. $\frac{1}{2}$ in. long, with stamens sometimes protruded. S. Calif. to Utah and S., on sunny slopes, blooming all winter in milder climates.—Little known in cult.

AAA. *Involucre containing 3 or more long-tubed fls.*

multiflora, Gray. Stout and tall (2-3 ft.), much-branched, somewhat pubescent or sometimes glabrous: lvs. rather thin, gray-green, lance-ovate to broad-ovate, more or less cordate, short-stalked, acute or acuminate: involucre $\frac{1}{2}$ in. long, stalked; fls. 6, with a tube often 2 in. long, rose to purple, the style and the 5 stamens protruded. Var. *pubescens*, Wats. (*M. Froebelii*, Greene), is very pubescent throughout. The *M. multiflora* of B.M. 6266 is probably this variety. The species ranges from Colo. and Texas to S. Calif. and south. Little known in cult.

2378. *Miscanthus sinensis*. ($\times \frac{1}{4}$)

longiflora, Linn. Plant 2-3 ft., glandular-pubescent above: lvs. cordate and usually acuminate, short-stalked, pubescent: fls. pubescent, with a very narrow tube 5-6 in. long, and a small, flaring white, rose or violet limb, very fragrant at evening. Mex.—An old garden plant, but less frequent than *M. Jalapa*; easily grown from seeds. It has been hybridized with *M. Jalapa*. L. H. B.

MIRASÖLIA: *Tithonia*.

MISCÁNTHUS (Greek, *miskos*, a stem, and *anthos*, a flower). *Gramineæ*. EULALIA. Tall perennial grasses with ample terminal feathery fan-shaped panicles, allied to the sugar-cane and Erianthus; often planted for bold lawn specimens and in borders.

Spikelets 1-fl'd., in pairs at the joints of the rachis, one nearly sessile, the other pedicellate, usually awned; clusters of silky hairs arising from the bases of the spikelets give the panicle its beautiful feathery appearance.—Comprises about 6 species in S. and E. Asia, several of which are cult. for ornament. Includes the eulalias of the trade but not Eulalia, Kunth, which is referred to Pollinia, by Hackel.

Although many progressive nurserymen now advertise these favorite grasses as *Miscanthus*, the name eulalia will probably remain in the English language as a thoroughly naturalized word, like geranium and chrysanthemum. Eulalias probably rank among the

first half-dozen most popular grasses cultivated for ornament. They are remarkably hardy and are universal favorites for bedding. One of the commonest and best designs for a bed of ornamental grasses employs *Arundo Donax* as a tall centerpiece, surrounded by eulalias. Propagated by seed or division of roots.

saccharifer, Benth. (sometimes written *sacchariflorus*. *Imperata sacchariflora*, Maxim.). Distinguished by its nearly or quite awnless spikelets. China. Gt. 1862:357.—Procurable of dealers in Japanese plants.

nepalensis, Hack. HIMALAYA FAIRY-GRASS. Spikelets one-fourth as long as the brown involucre hairs: lvs. smooth on the margin. Himalayas.—Occasionally cult.

sinensis, Anders. (*Eulalia japonica*, Trin.). Figs. 2378, 2379. Spikelets about equaling the white or sub-violet involucre hairs: culm 4-9 ft.: lvs. 2-3 ft., margins scabrous: panicle 6-12 in., formed late in the season.—Established plants form clumps as much as 18 ft. in circum. Sometimes found escaped from cult. The forms in cult. are mostly the following varieties: Var. *variegatus*, with lvs. striped; var. *zebrinus*, lvs. banded. These two varieties are not quite so hardy as the type, and are usually prop. by division, as the seeds are not so sure to come true. Gn. 61, p. 74. Gng. 4: 375; 6: 107. B.M. 7304. G.W. 3: 423. Var. *gracillimus* (*Eulalia gracillima univittata*, *E. japonica gracillima*, etc.). Lvs. much narrower than the type. Gn. 50, p. 108. Gng. 5: 273. R.B. 21, p. 179.

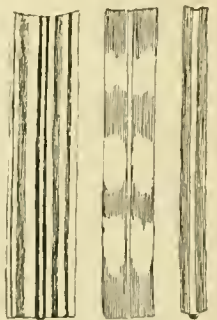
A. S. HITCHCOCK.

MISCHOPHLEÛS (stem and bark, of no evident application). *Palmæcæ*. One unarmed palm of medium height with pinnatisect lvs., from the island of Ternate in the Malay Archipelago, listed abroad. It is allied to *Areca*, from which it differs in having more stamens (9), in having the inferior fls. on the spadix branches in 3's rather than in 2's or solitary, and in other technical characters. The species is *M. paniculata*, Scheff. Lvs. terminal, unequally pinnatisect, the segms. lanceolate and double-toothed and mostly many-nerved: fls. small, in double-branched spadices: fr. ovoid, with terminal stigma, the pericarp fleshy or fibrous.

MISTLETOE of the Old World is *Viscum album*; of America, *Phoradendron flavesceus*. See, also, *Loranthus*.

MITCHELLA (Dr. John Mitchell, of Virginia, one of the first American botanists, correspondent of Linneus). *Rubiæcæ*. PARTRIDGE-BERRY. TWIN-BERRY. SQUAW-BERRY. A very attractive native trailer.

There are two species of *Mitchella*, one of which (*M. undulata*, Sieb. & Zucc.) grows in Japan. The native partridge-berry has small shining evergreen roundish lvs., sometimes marked with white lines, and bright scarlet berries, often borne in pairs, which remain all winter. This plant can be easily collected, and is also procurable from dealers in hardy plants. It thrives under evergreen trees, forming mats. Little pans with fruiting plants are often sold by florists in midwinter, particularly about Christmas time. The fls., which are borne in spring, are small white, with pinkish throats, and are fragrant. The berries are edible, but nearly tasteless. Fls. twin, the ovaries united into one calyx 4-toothed; corolla funnel-shaped, 4-lobed; lobes spreading, densely bearded inside, valvate in the bud: fr. a 2-eyed berry or double berry, red (rarely white), persisting through the winter.



2379. Variegation in *Miscanthus sinensis*. At the left, *variegatus*; middle, *zebrinus*; right, *gracillimus*.

repens, Linn. PARTRIDGE-BERRY. SQUAW-BERRY. Fig. 2380. Lvs. opposite, round-ovate, petioled, with minute stipules, often whitish veined; fls. in pairs, on the apex of a peduncle. Nova Scotia to Minn., south to Fla. and Mex. Mn. 3:49. L.B.C. 10:979. Gn.M. 2:19.—Attractive in half-shaded spots in the wild garden and rockeries. Prop. by division. L. H. B.†



2380. *Mitchella repens*.—Partridge-berry. (× 1/2)

MITÉLLA (diminutive of *mitra*, a cap; applied to the form of the young pod). *Saxifragaceæ*. MITREWORT. BISHOP'S-CAP. Low slender perennials, with somewhat creeping rootstocks and racemes of small and greenish or white flowers, sometimes planted in shady places.

Closely related to *Tiarella*, but the petals of the latter are entire, while in *Mitella* they are pinnatifid: lvs. round, heart-shaped, mostly alternate, on rootstock or runners, with slender petioles; those on flowering sts. opposite, if any; calyx short, 5-lobed, the lobes valvate in the bud, spreading; petals 5, inserted on throat of calyx, very slender; stamens 10 or 5, very short; fr. soon widely dehiscent. A few natives of N. Amer., 2 species in E. Asia.—Offered by some dealers in native plants.

A. *Scapes usually leafless*.

B. *Fls. numerous*.

trifida, Graham (*Ozomëlis trifida*, Rydb.). Lvs. round-reniform or cordate, crenately toothed and sometimes incised or lobed, 1-3 in. across; scape 9-12 in. long; fls. somewhat scattered on one side of spike; petals 3-5-parted, small; stamens 5, opposite the calyx-lobes. Canadian Rockies.

BB. *Fls. few (about 5)*.

nuda, Linn. Lvs. rounded or kidney-shaped, deeply and doubly crenate; raceme 4-6 in. long. Does well in moist shady situations. May-July. Labrador to Brit. Col. and south to Pa., in bogs and cold woods. A.G. 13:518.

AA. *Scapes bearing lvs.*

B. *Lvs. on scape alternate*.

caulescens, Nutt. (*Mitellastrea caulescens*, Howell). Raceme loose; stamens alternate with the pinnatifid petals. Mont. to Brit. Col. and N. Calif.

BB. *Lvs. on scape opposite*.

diphylla, Linn. Lvs. acutely heart-shaped, somewhat 3-5-lobed, toothed; raceme 6-8 in. long. May. Que. to N. C. and Mo. V. 12:189.—A good plant for the rockery. M. B. COULSTON. L. H. B.†

MITRÀRIA (from the mitre-shaped pods). *Gesneriaceæ*. One Chilean scandent shrub, prized for its bright scarlet flowers.

Leaves opposite, usually small, few-toothed; fls. stalked, solitary in the axils; calyx relatively small, free, 4-5-parted, with 2-lobed large bracts; corolla-tube much exceeding the calyx, ventricose and contracted near the top, the 5 lobes nearly equal; stamens 4,

attached near the bottom of the corolla. *M. coccinea*, Cav., is the only species: lvs. ovate and acute; fls. about 1½ in. long, pendent on peduncles much exceeding the lvs. Chile. B.M. 4462. F.S. 4:385. J.H. III. 48:471. G. 5:461; 36:847.—It is a dense-growing subscandent evergreen greenhouse plant (standing out-of-doors in parts of England), of easy cult., blooming in summer and autumn.

MITREWORT: *Mitella*. False M., *Tiarella*.

MITRIOSTÍGMA

(Greek, *mitre-shaped stigma*, from the conspicuous stigma, which is club-shaped, the 2-cut summit suggesting a cap). *Rubiaceæ*. This genus includes the charming evergreen tender shrub known to the trade as *Gardenia citriodora*. It makes a low or medium-sized bush of compact and branching habit and bears a great profusion of fls. that

resemble those of the orange in odor, size, color and general appearance. The fls. are white, salver-shaped, 5-lobed, tipped with pink in the bud, and borne in dense axillary clusters. This plant is a favorite in the S., together with the Cape jessamine, but is little known in northern conservatories. The genus contains 2 species in Afr., very like *Gardenia* and distinguished by technical characters as the 2-celled rather than 1-celled ovary.

axillare, Hochst. (*Gardënia citriodora*, Hook.). Lvs. opposite, petiolate, elliptic-lanceolate, subacuminate, glabrous; stipules awl-shaped from a broad base: calyx not ribbed, lobes lanceolate, acuminate, equal; corolla salver-shaped, the tube twice as long as the calyx, lobes obovate, obtuse; fr. oval. S. Afr. B.M. 4987. R.H. 1859, p. 175; 1886:348. F.S. 12:1254. J.H. III. 48:449. Gn.W. 4:53.

WILHELM MILLER.

MOCCASIN FLOWER: North American name for species of *Cypripedium*.

MOCK ORANGE: *Philadelphus*.

MODÉCCA (an E. Indian name). *Passifloraceæ*. Thirty or more species of erect or twining and tendrill-climbing plants in the tropics of Afr., Asia, Austral., little known in cult. Herbs or undershrubs: lvs. alternate, entire or palmately 3-5-lobed, gland-bearing at base of blade: fl.-stalks axillary, terminating in a tendril, bearing greenish or whitish unisexual fls., the hypanthium or calyx-tube not elongated; male fls. with 5 very narrow laciniate petals included within the fl.-tube, 4-5 stamens and 5 staminodes or disk-glands; female fls. with 10 staminodes or disk-glands in 2 series, and a stipitate 1-celled ovary; both kinds of fls. with a corona of interesting structure: fr. a coriaceous or fleshy 3-valved or indehiscent caps. *M. senënsis*, Mast. (*Clemánthus senënsis*, Klotzsch. *Adënia senënsis*, Engler), is a tall-climbing shrub from Senna, Zambesi and other places in Trop. Afr.: glabrous and rather glaucous: lvs. 5-parted, pale green, glaucous beneath, the segms. narrow and obtuse: calyx corolla-like, pale yellow, narrow campanulate, about 1 in. long; petals very small and contained within the calyx. B.M. 7763. L. H. B.

MOEHRINGIA: *Arenaria*.

MÔHRIA (from Daniel Mohr, a German botanist; died 1808). *Schizaceæ*. A genus of S. African ferns, having the habit of *Cheilanthes*, but the sporangia of

the Schizaceae. *M. cafrorum*, Desv. Lvs. in tufts, 9–22 in. long, 2–4 in. broad, tripinnatifid, the pinnæ close, the pinnule oblong, deeply cut or pinnatifid. The lvs. have a pleasant odor when bruised. Interesting as a rarity but not of commercial value. *M. achillæ-folia*, Hort., is nearly quadripinnatifid, and is said to have a different odor.

R. C. BENEDICT.

MOLÍNIA (J. Molina, a writer upon Chilean plants). *Gramineæ*. A caespitose perennial allied to *Eragrostis*. Panicle contracted; spikelets sub-cylindrical, 2–4-fl., purplish; glumes short, somewhat unequal; lemma 3-nerved, rounded on back, pointed but awnless.—Species 1, native of Cent. Eu. and Temp. Asia, sparingly intro. in the U. S.

cærülea, Moench (*Alra caerülea*, Linn.). Culms tufted, 1–3 ft. high; lvs. rather rigid, slender pointed. The usual form in cult. is var. *variegata*, with striped lvs., used for bedding. Dept. Agric., Div. Agrost. 20:133.

A. S. HITCHCOCK.

MOLOPOSPERMUM (*striped seed*, a Greek compound). *Umbelliferae*. One species, *M. cicutarium*, DC. (*Ligusticum peloponnesiacum*, Linn.), a large perennial of the mountains of S. Eu., grown sometimes for its handsome dense foliage; prop. by division or by seeds: 3–5 ft. with large hollow sts.; lvs. ternately decompose, the lfts. lanceolate, with pinnatifid segms.; fls. small, in umbels, the terminal umbels larger, yellowish white, the flowering sts. standing well above the clump of foliage. G.W. 12, p. 411.—Hardy in England; thrives in good garden soils.

MÓLTZIA (Count Joachim Gadske Moltke, Denmark, died 1818). *Boraginaceæ*. About a half-dozen perennial cano-pubescent mostly caespitose herbs allied to *Lithospermum*, but having stamens exserted and different nutlets; S. Eu. and Asia. Fls. blue or yellow, racemose or in terminal cymes; corolla-tube more or less funnel-shaped, the broad throat naked or hairy, the 5 lobes obtuse, erect or nearly so (spreading in *Lithospermum*); stamens 5. Two or 3 of the species are used more or less in rock-gardens and as alpinæ.

petraea, Boiss. (*Lithospermum petraeum*, A. DC. *Échium peretum*, Tratt.), from southeastern Eu., is a good rock-plant, 6–8 in., more or less woody, hoary; lvs. to 1½ in. long, narrow-linear to linear-oblong, the margins recurved; fls. deep violet-blue, in simple forked or branching revolute cymes; corolla-tube twice as long as calyx; lobes erect, short and rounded; style slender, exserted. B.M. 5942. B.R. 29:26.

cærülea, Lehm. Suffrutescent, the sts. erect, rigid and thickish, with crowded lvs., caescent; lvs. oblong-spatulate and obtuse, those on the st. linear-lanceolate and somewhat acute; fls. blue, in scorpioid racemes, the corolla-tube slender and exceeding the calyx; filaments exserted; calyx-lobes linear-lanceolate. Asia Minor.

graminifolia, Benth. & Hook. (*L. graminifolium*, Viv.). By some kept in *Lithospermum*: st. somewhat woody below, but ascending, appressed-hairy; lvs. linear, revolute; fls. purple-blue, about ½ in. long, the corolla glabrous and with erect lobes; stamens somewhat exserted. Italy. G.C. III. 47:213. Gn. 65, p. 147. Gn.W. 21:668.—A dwarf shrub with grayish lvs., said to prefer a dry and sunny place on limestone.

L. H. B.

MOLUCCÉLLA (diminutive, made from Molucca). Also written *Molluccella*. *Labiateæ*. Half-hardy annuals, flowering in midsummer, interesting because of the cup-shaped calyx.

Annual: corolla-tube included, with an oblique hairy ring within, the upper lip erect, the lower trilobed, the middle lobe broader, notched; stamens ascending under the hood, the anthers attached by lateral pedicels to the tip of the filament, cells divergent; style bifid; nutlets 4, convex on one side, angular on the other, broader

upward, truncate.—Of 25 described names only 2 now remain in this genus as accepted species. Benth. & Hooker place this genus near *Lamium*. Other genera of garden value in which the upper lip of the corolla is concave or vaulted and often villous within are *Stachys*, *Leonurus* and *Phlomis*. From these *Moluccella* is easily distinguished by its calyx. The fls. are white, tipped pink, scarcely if at all thrust out of the calyx, and borne in whorls of 6–10.

To this genus belongs the shell-flower, a quaint old annual plant, that self-sows in old-fashioned gardens, but is now rarely advertised for sale. Start the seed in frames in February and March; the seedlings may be transplanted to the rockery or border in May. They seem to like a sandy loam.

A. Calyx not prickly.

lævis, Linn. SHELL-FLOWER (so called because of the shell-like calyx in which the seeds nestle like eggs). *MOLUCCA BALM*. Fig. 2381. Height 2–3 ft.: st. simple or branching below, fl.-bearing almost from the base; lvs. long-petioled, rounded-subcordate, teeth coarse, round; fls. in whorls, 6-fl.; bracts shorter than calyx-tube; corolla white, shorter than calyx; calyx bears 5 small thorns. W. Asia. B.M. 1852.—Fls. odorless.

AA. Calyx beset with long prickles.

spinosa, Linn. Height 6–8 ft.: lvs. ovate, deeply and sharply cut; fls. in whorls, 6–10-fl.; bracts subulate, spiny, shorter than calyx-tube; corolla white, limb longer than calyx-tube; calyx with 1 long spine above and 7 others below. S. Eu., Syria. B.R. 1244 (as *Chasmonia incisa*).—Annual or biennial, with brownish red square sts., bristling calyx and gaping corolla. Said to have been cult. in England since 1596.

WILHELM MILLER.

A. C. HOTTES.†

MOMORDICA

(*mamordi*, from *mordeo*, to bite, since the seeds appear to have been bitten). *Cucurbitaceæ*. Annual or perennial tendril-climbing herbs of tropical countries, some of which are cultivated for ornament and also for the edible fruits.

Annual or perennial: fls. monoecious or dioecious, the staminate solitary or panicle, the pistillate solitary; corolla and calyx similar in sterile and fertile fls.; corolla-segms. 5, often extending nearly to the base, making a rotate or broadly campanulate fl.; stamens usually 3, the short filaments free, one of the anthers 1-loculed and the others 2-loculed; style single and long, with 3 stigmas: fr. oblong or nearly spherical, small, often rough, usually many-seeded, sometimes splitting into 3 valves, but usually indehiscent; seeds usually flattened, often oddly marked or sculptured: tendrils simple, in this distinguished from *Luffa*.—Species about 35, chiefly in Trop. Afr. also Trop. Asia. Two momordicas (*M. Charantia* and *M. Balsamina*) are



2381. *Moluccella laevis*. (×½)

known to American gardens as ornamental vines, but the frs. of *M. Charantia* are eaten by the American Chinese. They are tender annuals and thrive where cucumbers and gourds will grow. They are excellent in the S. for covering porches and arbors. *M. Elaterium* of the catalogues is *Ecballium*, which see.

A. Bract usually about midway (or at base) on the peduncle, entire: all peduncles bracted.

Charántia, Linn. BALSAM PEAR. Fig. 2382. Running 10 ft. or more, the st. slightly pubescent and furrowed: lvs. roundish, dull green, pubescent beneath (at least on the ribs), 5-7 lobes with rounded sinuses, the lobes sharp-toothed and notched: fls. yellow, 1 in. across, both the sterile and fertile solitary: fr. yellowish, oblong, pointed, furrowed lengthwise and tuberculate, 6 or 7 in. long, at maturity splitting into 3 divisions and disclosing the bright scarlet arils of the white or brown carved seeds. Trop. Asia and Afr., and naturalized in W. Indies. B.M. 2455. G.C. III. 52:473. A.G. 13:525.—The Chinese gardeners about the American cities grow this plant under the name of la-kwa, for the edible pulpy arils surrounding the seeds, and also for the edible fr. itself (which is prepared, usually by boiling, before it is ripe). The rind is sometimes dried and used in medicinal preparations (see Bailey, Bull. No. 67, Cornell Exp. Sta., with illustrations). The odd seeds cause it to be called the "art pumpkin" by some persons.

Var *abbreviata*, Ser. (*M. zeylanica*, Mill.). Plant smaller: lobes of lvs. narrower: fr. shorter, ovate-mucronate, with rows of sharp spines; seeds small, commonly smooth. In the tropics.—Perhaps specifically distinct; but *M. Charantia* runs into many forms.

AA. Bract of sterile peduncle near the top, toothed: peduncle of fertile fl. bracted at base or not at all.

Balsamina, Linn. BALSAM APPLE. Slenderer and more graceful, bright green throughout, glabrous, the foliage smaller and neater: lvs. cordate-orbicular in

outline, 3 in. or less across, 3-5-lobed, with rounded sinuses, the lobes and the few notches or teeth acute: fls. solitary, nearly or quite 1 in. across, yellow, often with blackish center: fr. orange, 2-3 in. long, ovoid and more or less narrowed each way, smooth or tuberculate; seeds compressed, nearly smooth. Widely distributed in Afr. and Asia, and naturalized in the W. Indies. G.C. 1848:271. R.H. 1857, p. 182. G.M. 48:3.—A neat vine, growing 4-6 ft.

AAA. Bract near the top of the sterile peduncle, entire.

involucrâta, E. Meyer. Much like *M. Balsamina*, but teeth of lvs. blunt, with a short mucro, fls. larger, bract much larger: fls. white or cream-white, often dotted with black: fr. sulfur-yellow, changing to scarlet, bursting, 2 in. long. S. Afr. R.H. 1865:350 (as *M. Balsamina* var. *leucantha*). B.M. 6932.—A very slender and graceful climber, with the peduncle bract against the calyx, like an involucre. Intro. to American trade about 1890.

M. cochinchinensis, Spreng. (*M. mixta*, Roxbg.), is a large species with 3-lobed lvs., pale yellow, purple-eyed fls., 4 in. across, and an oblong, bright red fr. 4-7 in. long. Farther India. B.M. 5145. F.S. 14:1478. G.C. III. 16:531. G.M. 37:777.

L. H. B.

MONÁNTHE (named for the often solitary flower). *Crassulaceæ*. About 10 little fleshy herbs of the Canary Is. and Morocco. Perennial, tufted, mostly glandular-hairy: lvs. fleshy, clavate or cylindrical, opposite or alternate, part or all of them rosulate: fls. reddish or orange, on slender peduncles, solitary or in cymes or racemes; sepals connate at base; petals 6-12, small, lanceolate; scales broad and petal-like. Closely allied to *Cotyledon* and *Sempervivum*, and presumably requiring similar treatment. From *Sempervivum* it differs in the much more developed scales in the fl., opposite the carpels. Fanciers are likely to grow a number of species; the following description will indicate what the plants are like.

atlántica, Ball. Branches prostrate, 1-3 in. long, cylindric, bearing toward the end a dense imbricated rosette of 20 or more lvs., the latter about $\frac{1}{2}$ in. long: fls. golden yellow, speckled red on back, on peduncles from the ends of the branches; petals 6, elliptic-ovate, acuminate. Canaries, Morocco. B.M. 5988 (as *M. muralis*).

L. H. B.

MONÁRDA (after Nicolas Monardes, a Spanish physician and botanist, who published in 1571 a book containing accounts of American products. See Fig. 1850). *Labiata*. HORSE-MINT. Annual and perennial, erect, aromatic herbs.

Leaves dentate or serrate: calyx tubular, narrow, 15-nerved, nearly 5-toothed, mostly villous in the throat; fls. rather large, white, red, purplish, yellowish or mottled, in dense capitate clusters, mostly bracteate, terminal and sometimes axillary, the bracts often highly colored; corolla glabrous within, tube slightly dilated above; upper lip erect or arched; lower lip spreading, 3-lobed, the middle lobe larger or longer than the others; anther-bearing stamens 2, usually exserted, the posterior pair rudimentary or wanting; anthers linear; ovary 4-parted.—About 12 species, natives of N. Amer., including Mex.

This includes the Oswego tea (*M. didyma*), one of the most brilliant of our native wild flowers, being surpassed in the intensity of its red only by the cardinal-flower. It is a rather coarse herb, with large heads of gaping, wide-mouthed flowers, which have none of the refinement of the cardinal-flower. For mass effects, however, these plants are very striking. They grow wild along the banks of streams, lighting up the dark corners of the woods. This suggests their proper place in landscape gardening. They should be grown in masses, in wild spots against a dark background. However, they can, if desired, be grown in an ordinary sunny border without more moisture than usual. As a



2382. *Momordica Charantia*.
(Main spray $\times \frac{1}{4}$)

bedding plant they would be inferior to *Salvia coccinea*, the flowers being shorter-lived. The white- and rose-colored varieties are less desirable. *M. fistulosa* is the same type of plant, and is procurable in colors ranging from white, flesh-color and lilac, through rose and crimson to deep purple, but not scarlet. This species is very variable in height. The lighter-colored varieties are usually less robust.

Monardas are easy of culture, thriving in any good soil. They spread quickly, and therefore need frequent separation, which operation is best done in the spring, as plants disturbed in autumn will often winter-kill.

A. Calyx slightly hairy at the throat.

didyma, Linn. (*M. Kalmiana*, Pursh. *M. coccinea*, Hort.). OSWEGO TEA. BEE-BALM. FRAGRANT BALM. Fig. 2383. St. acutely 4-angled: lvs. thin, ovate-lanceolate, acuminate. B.M. 145 (erroneously as *M. fistulosa* var.), and 546. R.B. 26:49. G.W. 14, p. 618. Vars. *alba* and *rosea*, Hort., are offered, but the latter should be compared with the next species. In 1893 John Saul advertised *M. Kalmiana* as if horticulturally distinct, calling it the finest of monardas. Var. *salmonea*, Perry. Large heads of delicate shade of salmon-pink.—Suited to moister positions than the others.

AA. Calyx densely bearded at the throat.

B. Lvs. petioled.

fistulosa, Linn. WILD BERGAMOT. Sometimes called bergamot in nursery catalogues, but the bergamot of the Old World is *Mentha odorata*. St. mostly obtusely angled: lvs. firmer: fls. purple, usually not so numerous as *M. didyma*. July, later than *M. didyma*. Var. *rûbra*, Gray. Fls. crimson or rosy red. Var. *mêdia*, Gray (var. *purpurea*, Hort.). Fls. deep purple. Var. *purpurea*, Pursh. The deep purplish crimson fls. are smaller. L.B.C. 14:1396. Var. *môllis*, Benth. (*M. môllis*, Linn.). Fls. flesh-color to lilac. B.M. 2958 (as *M. menthaefolia*).—Will grow in dry positions.

Ramaley, A. Nelson. Similar to *M. fistulosa* but softly and lanately white-pubescent, densely so at the nodes: lvs. lanceolate or narrowly ovate; petioles short, lanately pubescent as are also the midribs of the lvs.: involueral lvs. scarcely purple-tinged: corolla lavender. Cent. Colo.—This species is catalogued as being dwarf, 1-2 ft., bearing bright clover-red fls.

BB. Lvs. nearly sessile, at least below.

Bradburyana, Beck. Fls. light purple, spotted darker on the middle lobe of the lower lip, which is much larger than the lateral ones. June. Ind. to Tenn. and Kans. B.M. 3310 (erroneously as *M. fistulosa flore-maculata*).—Will grow in dry positions.

WILHELM MILLER.

A. C. HOTTES.†

MONARDÉLLA (diminutive of *Monarda*, having its aspect, inflorescence and calyx). *Labiata*. Annual or perennial sweet-smelling herbs, natives of California.

Leaves entire or obscurely toothed: fls. rose, red, purple, or rarely, white, compacted in terminal heads with an involuere; calyx tubular, narrow or long, 10-13-



2383. *Monarda didyma*. (× 1/3)

nerved, 5-toothed; the teeth short, straight and nearly equal; the throat naked within; stamens 4, exserted.—About 15 species closely allied to *Pycnanthemum* and *Origanum*. The plants are best prop. by division in the spring. They prefer a sandy soil. The following have been advertised, and can be secured through western collectors.

A. Fls. large, few, rather loosely glomerate.

macrantha, Gray. Perennial, tufted, about 9 in. high: bracts of the 10-25-fl. head sometimes whitish or purplish tinged: corolla about 1½ in. long, glabrous, orange-red, its tube fully twice the length of the calyx; the lobes lanceolate. S. Calif.

nana, Gray. Pubescent: 9 in. high: bracts whitish or rose-color: fls. smaller than *M. macrantha*; corolla less than an inch long, white tinged with rose, the slender tube pubescent. S. Calif., in mountains near San Diego.

AA. Fls. smaller, more numerous, densely capitate.

B. Plants perennial.

villôsa, Benth. Soft-pubescent, or the heads and lower face of lvs. villous, or sometimes the whole herbage glabrate, 9-12 in. high: lvs. ovate, all petioled; veins conspicuous, widely spreading. Woods and banks. W. Calif., especially along coast. Farther inland is a form (var. *interior*, Jeps.) with coarsely toothed lvs. and large heads.

odoratissima, Benth. Cinereous-puberulent, or nearly glabrous: 9-12 in. tall: lvs. narrowly oblong to broadly lanceolate, entire or nearly so, short-petioled, or the upper subsessile, firm in texture; veins inconspicuous: bracts thin-membranaceous and colored (whitish or purple). Dry hills, Wash., Ore., and through higher mountains of Calif., Nev., Utah.—Odor of pennyroyal.

BB. Plants annual.

C. Corolla rose-red or purple.

lanceolata, Gray. Lvs. oblong-lanceolate or narrower, tapering into a slender petiole: corolla rose-color or purple: bracts leafy. Calif.

CC. Corolla white or nearly so, small and short.

cândicans, Benth. Lvs. lanceolate or narrowly oblong, tapering into a slender petiole: bracts minutely pubescent outside, greenish along numerous nerves. Calif.

A. C. HOTTES.†

MONÉLLA: *Cyrtanthus*.

MONÈSES (Greek, *single delight*; from the pretty solitary fl.). *Pyrolacæ*. ONE-FLOWERED PYROLA. One species, a low perennial herb: st. decumbent: lvs. roundish, clustered at base: fls. single, drooping, from top of slender scape 2-6 in. long, white or rose-colored, 6 lines across; petals 5, widely spreading, orbicular; filaments awl-shaped, naked; anthers as in *Pyrola*, but conspicuously 2-horned. *M. uniflora*, Gray (*M. grandiflora*, S. F. Gray. *Pyrola uniflora*, Linn.), grows in moist cold woodlands from Labrador to Alaska, in middle states and westward along the mountains. It has been offered among native plants.

MONEYWORT, or **CREEPING CHARLIE**, is *Lysimachia Nummularia*.

MONKEY-FLOWER: *Mimulus luteus*.

MONKEY-PUZZLE: *Araucaria imbricata*.

MONKSHOOD: *Aconitum*.

MONOCHÆTUM (*one bristle*, referring to the connective). *Melastomacæ*. Shrubs and subshrubs of tropical America, suitable for glasshouse culture, little grown.

Allied to *Rhexia*, but differing in the clavate-appendaged connective and other minor characters; mostly erect, pilose; lvs. 5-7-nerved, ovate or lanceolate; fls. paniculate, medium size, purple or rose; calyx-lobes 4, narrow, deciduous or persistent; petals 4; stamens 8, unlike, with glabrous filaments; fr. a 4-valved caps.—Species 30-40, Mex. to Peru. They are said to be of easy cult.; see *Melastoma* and *Medinilla* for similar plants. Prop. by cuttings.

A number of species may be found in the collections of fanciers. Probably the one most likely to be cult., and which is now offered abroad, is *M. sericeum*, Hort. (probably *M. sericeum*, Naudin=properly *M. Bonplandii*, Naudin). There is also a garden var. *multiflorum* of it, with handsome mauve fls. produced in abundance in spring. *M. Bonplandii* is shrubby, the branches somewhat hirsute; lvs. ovate, 5-nerved, entire, short-petioled, villous, and pubescent beneath; fls. axillary or terminal, violet. S. Amer., in the Amazon region.

L. H. B.

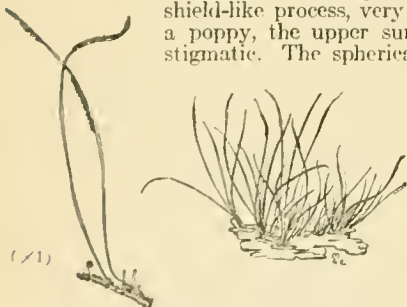
MONOCHÔRIA (name refers to the *one separate stamen*). Sometimes misspelled *Monocharia*. *Pontederiaceae*. A very few species of rhizomatous herbs allied to *Pontederia* but differing in the absence of perianth-tube, in erect rather than versatile anthers, and the ovary 3-celled and many-ovuled rather than 1-celled and 1-ovuled. The species are aquatic herbs in the tropics or subtropics of E. Asia, Afr., and Austral., with long radical and short cauline lvs., the blade cordate-ovate or lanceolate; raceme appearing to arise from the petiole of a scape-lf., bearing many blue or violet fls. Probably none is in the trade. *M. vaginalis*, Presl, of India, bears long-petioled oblong-lanceolate cordate acute lvs. with hollow petioles and is eaten when young as a pot-herb: 2 ft. high; fls. blue. G.W. 11, p. 388.

MONODÔRA (Greek, *single gift*, in allusion to the solitary flowers). *Annonaceae*. Trees, or shrubs, often with more or less climbing habit.

Flowers extra-axillary or opposite the lvs. or sometimes terminal, borne on a long bracteolate usually pendulous peduncle. This genus forms a distinct tribe distinguished from all other *Annonaceae* by a 1-celled compound ovary with numerous ovules attached to the inner walls. The fls. are composed of 3 valvate sepals, a corolla of 6 petals united at the base, many short stamens crowded on a spheroid receptacle bearing 2 elongated parallel pollen-sacs capped by the dilated apex of the connective. The ovary borne on the

summit of the receptacle expands into a shield-like process, very much like that of a poppy, the upper surface of which is stigmatic. The spherical gourd-like fr. is

closely packed with seeds having the small embryo and wrinkled endosperm which is characteristic of all *Annonaceae*. This genus though of African origin was first established from a plant



2384. *Monogramma trichodea*.

growing in Jamaica, certainly intro. from Afr. with negro slaves. Of the 11 species described by Engler & Diels, all African, 2 are of economic importance. They are little known as horticultural subjects.

Myristica, Dunal. **CALABASH NUTMEG**. Lvs. short-petioled, the blade firmly membranaceous or paper-like, glabrous, obovate or oblong-elliptical, cuneately narrowed toward the base, which is obscurely cordate;

apex more or less acuminate, primary lateral nerves 10-20, prominent beneath, curving upward, connected by secondary nerves almost at right angles to them; fls. fragrant, solitary, long-pedunculate, the peduncle bearing at or above the middle an ovate-lanceolate or suborbicular bracteole often more or less acuminate at the apex; outer petals more or less ovate-lanceolate, gradually narrowing toward the apex, undulate-crispate, white or yellowish, and variegated with purple or brown spots; interior petals shortly clawed, ovate-cordate obtuse, auriculate and pilose at the base; stigma with the circular margin scalloped or entire; fr. globose, more or less longitudinally striate or obscurely ribbed, with the pericarp thick, woody and gourd-like, often 4-6 in. diam., and hanging on a peduncle 24 in. long. An African tree endemic in the forests of Sierra Leone, Upper Guinea, Kamerun, Gabon, the Lower Congo, and Angola. In its native habitat it often reaches a height of 60 ft. or more; but in cult. it is usually much smaller.—The aromatic seeds, with the endosperm ruminant like that of a nutmeg, are highly prized by the native Africans. They are used medicinally and as a spice for seasoning food, and are offered for sale in local markets, strung together like rosaries.

angolensis, Welw. **ANGOLA CALABASH NUTMEG**. A shrub or tree sometimes reaching the height of 12 ft.: fls. very fragrant; outer petals undulate-crispate, variegated with purple, broadly ovate, erect and curving inward above the essential parts; inner petals rose-tinted or whitish in color, borne on a long narrow claw, dilated into a transversely elliptical or subrhomboid pilose limb; fr. is ovoid-ellipsoid, longitudinally striate and abruptly apiculate.—The aromatic seeds are used in the same way as those of the preceding species.

W. E. SAFFORD.

MONOGRÁMMA (Greek, a *single line*; alluding either to the grass-like lvs. or to the elongated linear sorus). *Polypodiaceae*. A tropical Old World genus of several small species of grass-like ferns, rarely seen in cult. *M. trichodea*, J. Smith (Fig. 2384), is a tiny bark-inhabiting plant with thread-like lvs., 1-2 in. long, native in the Philippines. It is of exceptional interest from the collector's standpoint because it is without exception, so far as known, the simplest and most delicate fern in existence. Its habitat is like that of most filmy and the cultural conditions required are also similar.

R. C. BENEDICT.

MONOLÈNA (Greek words referring to the single spur-like appendage on the anterior side of the anther-connective). *Melastomaceae*. About 5 species of stemless somewhat fleshy herbs from Cent. Amer., Colombia and Peru, one of which is a small hothouse foliage plant, cult. like *Bertolonia*, and known to the trade as *Bertolonia primulaeflora*. All the species have a characteristic rootstock, composed of clusters of short thick rhizomes, prominently scarred by the falling of the lvs., and the fls. are numerous, and resemble a primrose about 1 in. across, 5-petaled, pink, and borne on slender scapes; lvs. long-petioled, oblong to orbicular, entire or dentate. See *Bertolonia*.

primulaeflora, Hook. f. (*Bertolonia primulaeflora*, Hort.). Glabrous; lvs. leathery, broadly elliptical, the margins dentate and ciliate; calyx-lobes broadly ovate-rounded. B.M. 5818. F.S. 18, p. 162. G.C. 1870:309.—It has metallic green lvs. 4-6 in. long, with 3-5-parallel veins, the under surface of the lvs. being a showy rosy purple.

MONOLÔPIA (Greek, *one garment or husk*; referring to the involucre, the scales of which are united at base or into a cup). *Compósitae*. Yellow-fl. woolly annuals from Calif., with 8-10 pistillate rays which are 2-4-toothed or lobed; lvs. alternate (or lower ones opposite), sessile, entire or pinnately parted; peduncles

terminal, solitary, 1-fl.; heads large, many-fl.; some of the disk-rays sterile; lobes of disk-corollas somewhat bearded and ray-fls. with appendage at base of ligule; pappus none.—Species perhaps a half-dozen; of minor importance horticulturally.

major, DC. (*Heliconium Douglasii*, Hort.). Small and woolly in the wild, green and 2–3 ft. high in cult.: lvs. entire or somewhat toothed, sessile, linear to broadly lanceolate; fls. 2 in. across, yellow; rays dilated, coarsely 3–4-toothed, appendaged at the base. B.M. 3839.—Said to bloom most of the summer. Lvs. 3–5 in. long, reflexed: rays 8–9, fertile, short, broad and coarsely toothed, bright golden yellow.

L. H. B.

MONOMÉRIA (one part, referring to the single anther). *Orchidaceæ*. Two epiphytic orchids from India, allied to *Bulbophyllum*, little cult. Pseudobulbs 1-lvd., on a stout rhizome, the lf. long, thick and flat: scape arising from the rhizome and bearing a loose raceme; petals minute, fimbriate; dorsal sepal broad and erect, the lateral much longer; lip small, jointed on the column-base, subcordate; column very short, 3-toothed; anther 1-celled; pollinia 4. *M. barbata*, Lindl., has scape about 1 ft. long, and fls. about 1¼ in. long, greenish marked red-brown. Sikkim.

MONÓPANAX: *Oreopanax*.

MONOTÁGMA (single row or series, from the Greek). *Marantaceæ*. Maranta-like plants, about 10 species, in S. Amer., one of which is in cult. It belongs to the 1-located section of the family, with a single staminodium; differs from *Ischnosiphon*, among other things, in its solitary rather than geminate fls. *M. smaragdinum*, Schum. (*Maranta smaragdina*, Lind. *Calathæa smaragdina*, Lind. *Ischnosiphon smaragdinum*, Eichl.). Erect perennial showy herb, 1–1½ ft.: lvs. long-petioled, lanceolate or oblong-lanceolate, acuminate, the base more or less rounded, emerald-green above with a dark green central stripe, beneath pale green and minutely puberulent: fls. 4–8, solitary, disposed in spikes; sepals lanceolate; corolla-tube much exceeding calyx, the lobes lanceolate and obtuse; staminode obovate. Ecuador.

L. H. B.

MONSÓNIA (named for Lady Ann Monson, correspondent of Linnaeus). *Geraniaceæ*. Erect or decumbent herbs or shrubs, sometimes grown under glass as are pelargoniums.

Annual or perennial, mostly with slender sts.: lvs. alternate or opposite, crenate-dentate or dissected, stipulate; peduncles axillary or rarely nearly basal, bracteate, 2- to many-fl., or rarely 1-fl. by abortion; fls. white, rose-colored, red, purplish, regular; sepals and petals and glands 5; stamens 15, all fertile, connate at base; ovary 5-lobed and 5-celled, beaked: valves of fr. 1-seeded, revolutely dehiscent.—Species 29 as accepted by Knuth in Engler's *Das Pflanzenreich*, hft. 53 (1912), African, 2 or 3 extending into Asia. Probably the species most likely to be met with in cult. are *M. lobata*, Mont., and *M. speciosa*, Linn. f., suffruticose plants 1 ft. or so high, from S. Afr. The former has lvs. cordate and 5–7-lobed, and fls. greenish and variegated outside and pale bluish inside with darker center. B.M. 385. The latter has lvs. palmately 5-parted and lobes 2-pinnatifid, and fls. rose-colored with darker eye. B.M. 73.

L. H. B.

MONSTÈRA (name unexplained by the author; probably from the Latin for *strange* or *monstrous*). *Araceæ*. Root-climbing evergreen aroids from tropical America, of which one, *Monstera deliciosa*, is often grown under glass for its odd foliage and in the tropics for its edible fruit.

Woody, the branches rooting, the roots often cord-like, the lvs. more or less distichous: lvs. often very large (small on juvenile shoots and more regular), from lanceolate to oblong and broader, entire, perforated or pinnatifid, the petiole prominent and sheathing: peduncles terminal, solitary or fascicled, bearing ovate or oblong boat-shaped spathe that opens widely after flowering and finally is deciduous: spadix shorter than the spathe, cylindrical or nearly so, densely flowered,



2385. *Monstera deliciosa*.

bearing the hermaphrodite or perfect fls. above and sterile fls. below; fertile or perfect fls. with no perianth, and 4 stamens, and a 2-celled ovary with 2 ovules in each cell: frs. many small berries, crowded or joined into a multiple fr. or cone-like structure.—Species 27 as monographed by Engler & Krause in Engler's *Pflanzenreich*, hft. 37 (1908).

The species commonly known in horticulture is *Monstera deliciosa*, the ceriman (Fig. 2385). It is a greenhouse climber, with huge perforated leaves. As the plant climbs, the stems emit long aerial roots, many of which never reach the ground. The plant bears an edible fruit, which has a taste between a pineapple and a banana. The fruit grows about 6 to 8 inches long, and looks like a long pine-cone, the rind being composed of hexagonal plates. The monstera is a satisfactory greenhouse subject, even in a young stage, and being a great curiosity, excites much comment from visitors. It is usually kept in a hothouse, but succeeds in a coolhouse also. It is commonly allowed to grow in a spreading rather than climbing fashion. As a conservatory plant it does best when planted out in a bed of rich soil, where it can be kept within bounds by judicious pruning. It is not particular as to soil, as it fills the pots in which it is planted with thick succulent roots in a very short time. It is one of the best plants for enduring the varying conditions of tem-

perature in a dwelling-house, as nothing short of a freeze seems to hurt it.

The propagation of monstera is easily accomplished by division of the growing stems. These can be cut up into lengths so as to include two or three joints placed in a propagating-bed with bottom heat of 75° to 80°. A good method is to place each cutting in a 3-inch pot, filled with a mixture of sand, peat and leaf-mold in equal parts. Plunge the pots up to the rims in a warm propagating-bed and cover with glass so as to insure a humid atmosphere. When they have made new roots they can be taken out of the propagating-bed and placed on a bench in a house, with a night temperature of 65° to 70° with a rise during bright days to 80° or 85°. While they will grow in 8 to 10° cooler temperature, they will never come to their full perfection without plenty of heat. As the pots become filled with roots, they should be shifted until the plants are in 10- or 12-inch pots or tubs. They may also be planted out along some wall or pillar in the greenhouse. Monstera is tropical climber, so will need some mode of support to keep them growing in their natural habit. For a compost they like a turfy soil three parts, leaf-mold and well-rotted manure one part each; to this add enough sand to make it porous. Give plenty of ventilation. They should be syringed frequently during the spring, summer and fall months. During the summer, they require plenty of water to keep up their vigorous growth. When monstera is wanted to ramble over a large area, they should be given much liquid feeding. They will need a little shade during the hottest part of the summer, but no more than is necessary to hold the foliage in good color, as it only tends to make them grow soft and flabby. During the winter months, it is always better to lessen the water-supply as they are in a state of dormancy until about the end of January when they will show renewed state of activity. These plants are not troubled with many insects. The texture of their leaves will allow syringing to such an extent as to dislodge any kind of pest. (J. J. M. Farrell.)

In the American tropics *M. deliciosa* requires a very warm moist climate for the production of fruit. Although it naturally grows by attaching itself to trees and creeping up, it appears to be more fruitful if compelled to grow on the ground without climbing. The fruit is green in color until it ripens, when there is just a tinge of yellow, and the outer rind comes off in bits at a touch.

The plant known to the trade as *Marcgravia paradoxa* is *Monstera dubia*. The adult leaves are something like those of *M. deliciosa*, being now and then perforated, but usually pinnately cut. The young leaves are very different, being much smaller, entire and heart-shaped. In its young stage, *M. dubia* is a very handsome hothouse climber, with thick roundish waxy leaves, which grow in two ranks and overlap one another. When the plant was introduced by Bull, it was shown growing on a board apparently in parasitic fashion, and emitting aerial roots. It seemed most like a *Marcgravia*, but when it flowered and fruited the first name was found to be incorrect. *Marcgravia* is a dicotyledon and *Monstera* a monocotyledon. The monstera-like leaves are likely to be developed when the plant reaches 15 feet. In the young stage the plant is generally allowed to clamber over a dead log or tree-ferm trunk, in the manner of *Philodendron*, which see for culture.

deliciosa, Liebm. (*M. Lénnea*, Koch. *Philodendron pertusum*, Kunth & Bouché). GERMAN. Fig. 2385. Sts. strong, terete, climbing high: lf.-blades 1-2 ft. and more long, leathery, pinnately cut, perforated, the petiole very long. Mex., Guatemala. A.F. 7:253. G.M. 41:329. Gn. 21, p. 39.

dubia, Engler & Krause (*M. tenuis*, C. Koch. *Marcgravia dubia*, Kunth. *M. paradoxa*, Bull).

SHINGLE PLANT. Young lvs. a few inches long, waxy, entire; mature lvs. pinnatifid, the segms. narrow-linear and acute. Mex. Gn. 29, p. 290 (both kinds of lvs.). G.C. II. 8:13.

latevaginàta, Engler & Krause (*Pòthos celatocàilis*, N. E. Br.). Sts. flat on under side, lying close to support: early lvs. distichous and overlapping, broad-elliptic, sessile, dark velvety green, appressed to support; older lvs. larger, lobed, free. Trop. Amer. F.S. 23:2419, 2420. I.II. 30:496. L. II. B.†

MONTANÒA (Montano, a Mexican statesman). Sometimes spelled *Montàgnaxa*. *Compòsitæ*. Shrubs or even small trees, pot-plants being used sometimes for subtropical bedding and for winter bloom; somewhat allied botanically to *Rudbeckia*.

Strong mostly robust plants, mostly pubescent or tomentose: lvs. opposite, entire, dentate or even pinnatifid; heads small or medium, corymbose-paniculate, heterogamous, radiate; ray-florets neutral, in 1 series; disk-florets perfect but the innermost sterile; receptacle convex or conical, with carinate scales about the fls.; corolla white or rose-colored.—About 20 species, Mex. to Colombia. They are of easy cult.; the seeds are started indoors and the plants may be transferred to the open for foliage effects, as are *melianthus*, the large solanums and others; prop. also by cuttings. Several of the species are likely to appear in collections in subtropical gardens.

bipinnatifida, Koch (*Polýmnia grándis*, Hort.). Erect and strong, half-shrubby, to 8 ft.: lvs. pinnatifid or 2-pinnatifid, more or less hairy, the segms. serrate or notched: heads 3 in. diam., with showy pure white rays. Mex. G.C. III. 39:123; 42:419. Gn. 72:308. G. 30:277. G.M. 50:903. R.H. 1910, p. 175.—A striking subject either for winter bloom indoors or for bedding out with bold planting.

mollissima, Brongn. Branching shrub, more branching and stiffer than *M. bipinnatifida*, 6 ft., the branches pubescent but becoming almost glabrous: lvs. lanceolate or ovate lanceolate, about 6 in. long, sessile, dentate, white-tomentose beneath, veiny, soft to the touch: heads 1½ in. diam. on long peduncles, the rays about 9 and white, the disk yellow. Mex. B.M. 8143.—This and *M. grandiflora*, DC., are confused, but the latter (which may be in cult.) has very rough and scabrous lvs. that are brown-hairy beneath; what is known in cult. as *M. grandiflora* is probably diverse. Mex. G.C. III. 43:40. Gn. 74, p. 623.

Wércklei, Berger. A recent species from Costa Rica: shrub, to 20 ft., the branches white-tomentose: lvs. petioled, 5-7-lobed or trifoliate or unequally pinnate, soft-pubescent, 8-10 in. long, the lfts. small: heads about 2 in. across, probably white, in broad corymbs. L. H. B.

MONTBRÈTIA: *Tritonia*.

MONTEREY CYPRESS: *Cupressus macrocarpa*.

MONTEREY PINE: *Pinus radiata*.

MÓNTIA (Giuseppe Monti, professor of botany at Bologna in the first half of the eighteenth century). *Portulacacææ*. Small glabrous herbs, grown for ornament and one as a salad or pot-herb; annual and perennial.

Leaves opposite, fleshy; fls. minute, nodding solitary or loosely racemed, white, or pale rose-color; sepals 2 (rarely 3), broadly ovate, persistent; petals 3, more or less united; stamens 3 (rarely 5), inserted on the corolla; ovary 3-ovuled; style short, 3-parted: caps. 3-valved, 3-seeded; seeds nearly orbicular, compressed, minutely tuberculate.—About 18 species of American herbs, including the winter purslane, a salad or pot-herb known to the European trade as *Claytonia perfoliata*. This odd plant is perhaps cult. in Amer. by a

few fanciers of rarer kinds of vegetables. In hot countries it may be more desirable. The most remarkable feature is a sort of cup an inch or more in diam., from which arise the racemes of small white or rose-colored fls. One of these cups crowns each of the sts., which are numerous, slender, leafless, and about twice as long as the lvs. The name "perfoliata" is suggested by the resemblance of the cup to a perfoliate lf. In *M. perfoliata* the cup is usually 2-lobed; and the species runs into *M. parviflora*, which rarely has the cup transformed into 2 almost disjointed lvs. *M. fontana* is the aquatic or semi-aquatic species found in most of the temperate regions of the world. The winter purslane is now a weed in many parts of the world. The seed may be sown all through spring and summer where the plants are to stand. *Montia* cannot be distinguished from *Claytonia* by any one character, but the cult. plants of both genera have been sufficiently discriminated here and under *Claytonia*.

A. *Sts. without true lvs.*

perfoliata, Howell (*Claytonia perfoliata*, Don). WINTER PURSLANE. Rather coarse, green, often reddening with age; radical lvs. from subreniform to spatulate-obovate, often 1-3 in. broad; cauline lvs. merely flattened disks; pedicels not longer than the fruiting calyx; petals white, little surpassing the calyx. Banks of streams, Calif. to Ariz. and Mex., north to Brit. Col.; common near Pacific coast. It grows wild in Cuba but is not native there, as often stated. B.M. 1336. R.H. 1897, p. 159. Annual.

parviflora, Howell (*Claytonia parviflora*, Douglas). More slender, green or slightly glaucous; radical lvs. spatulate to filiform-linear; pedicels slender, much longer than calyx; petals white or pale rose-color hardly double length of calyx. Calif. to Brit. Col., east to Idaho and Utah. Annual.

AA. *Sts. leafy.*

B. *Lvs. alternate, numerous, small.*

parvifolia, Greene (*Claytonia parvifolia*, Moc.). *Sts.* a span to a foot long, ascending or some procumbent, sometimes reduced to naked runners; radical and lower cauline lvs. rhomboid-obovate, about $\frac{1}{2}$ in. long, contracted at base into a slender petiole; upper narrower and small; fls. few and racemose, rose-color varying to white. The plant has bulb-like offshoots in the axils of the cauline lvs. Moist rocks, Brit. Col. to Rockies in Mont. and Alaska.—Of very little ornamental value. Apparently perennial.

BB. *Lvs. opposite.*

fontana, Linn. WATER or BLINKING CHICKWEED. BLINKS. WATER-BLINKS. Densely tufted, very green, weak, diffuse or ascending, 1-6 in. long, freely branching; lvs. spatulate or obovate, mainly obtuse, $\frac{1}{2}$ in. broad or less; fls. nodding, solitary and terminal or in a small, loose, leafy-bracted raceme; sepals obtuse, slightly shorter than the petals; caps. globose, nearly $\frac{1}{2}$ in. diam.—Wet places, Que., Maine, Nova Scotia, Newfoundland, mountains of Calif. Summer. Annual, or perennial by rooting at the nodes. A. C. HOTTES.†

MOON DAISY: name used in England for *Chrysanthemum Leucanthemum* and other species. See page 754.

MOONFLOWER in America always means *Calonyction aculeatum* and related species; in England it rarely, if ever, means this, but *Chrysanthemum Leucanthemum*. Moonflower in England also means sometimes *Anemone nemorosa* and *Stellaria Holostea*.

MOONSEED: *Menispermum canadense*.

MOONWORT: *Botrychium*; also *Lunaria*.

MOOREA (named in 1890 for F. W. Moore, curator of the Glasnevin Botanic Garden, Ireland). *Orchidaceæ*. One handsome warmhouse orchid, something like *Houl-*

letia, from which it differs in the lip having no claw and being articulated with the foot of the column and the midlobe or epichile not articulated with the hypochile.

irrorata, Rolfe. Pseudobulbs ovoid, to 3 in. high; lvs. 2, plicate, to 2 or 3 ft. tall and 8 in. broad; scapes much shorter than or equaling the lvs., several-to many-flid.; fls. about 2 in. diam., the sepals and petals red-brown and whitish at base; lip smaller, 3-lobed, straw-yellow with dark purple lines, the crest bright yellow; column stout and incurved; pollinia of 2 unequal pairs. Probably Colombia. B.M. 7262. G.C. III. 11:489; 29:248. J.H. III. 42:277. G.W. 15, p. 431.—The cult. is similar to that for *houletia*; to be potted in a mixture of peat, sphagnum and a little fibrous loam; should be rested after growth. It is easily grown and free-flowering, doing well in a cattleya house.

L. H. B.

MOOSEWOOD: *Dirca palustris* and *Acer pennsylvanicum*.

MORÆA (from a personal name). *Iridaceæ*. MOREA. Charming bulb plants much like irises, but they are not so hardy as the common irises and the individual flowers last only a day or so; of interest to amateurs.

Mostly having corms except in subgenus *Dietes* which has a short rhizome; perianth-tube obsolete; outer segms. obovate-cuneate, with a reflexing limb; inner similar, smaller; stamens with anthers like those of *Iris*, but filaments more or less connate; ovary, style, caps., and seed as in *Iris*: lvs. few, linear or ensiform; fls. 2 or more, clustered, various in color, usually fugitive.—About 60 species, 45 of which are S. African, while the others are chiefly from Trop. Afr., one species being found in Austral. *Moræa* is the African representative of *Iris*. No one character will separate the two genera. *Moræas* have no perianth-tube, while irises usually have one. The filaments are usually monadelphous in *Moræa* and free in *Iris*. Irises grow either from rhizomes or bulbs, while *moræas* mostly grow from corms, except the subgenus *Dietes*, which grows from a rhizome. Most of the showiest *moræas* belong to the subgenus known as *Moræa* proper. There is another subgenus which differs from it in having the ovary extended into a long beak which looks like a perianth-tube, but none of this group is cult. The *moræas* proper are about as tender as other Cape bulbs. The amateur may find some suggestions as to their cult. under *Bulbs*, *Iris* and *Iria*.

By far the largest and most remarkable plant of the genus is *Moræa Robinsoniana*. This grows 6 to 8 feet high and has the habit of the New Zealand flax, *Phormium tenax*. A splendid specimen mentioned in B.M. 7212 bore 457 flowers between June 20 and October 1. The individual flowers are 4 inches across, fragrant and last only a day. At Kew this noble plant has been successfully grown in the south end of a house. The stately plant pictured in G.F. 10:255 grew in a Californian garden and was said to be sixteen years old from seed. The finest picture, however, is that in G.F. 4:355.

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A. *Rootstock a corm, tunicated; ovary not beaked.*

B. *Inner segms. conspicuous.*

C. *Plants dwarf, 4-6 in. tall.*

D. *Lvs. hairy all over.*

1. **papilionacea**, Ker. Very dwarf, 4-6 in. tall; fls. red or lilac, yellow on the claw; style-crests erect; sts.

simple or forked low down, bearing 1-6 clusters on short erect peduncles: lvs. hairy all over, linear, 3-6 in. long; caps. oblong, $\frac{1}{3}$ in. long. S. Afr. B.M. 750.

DD. Lvs. hairy only at edges.

2. *fimbriata*, Klatt. Very dwarf, 4-6 in. tall: fls. lilac: sts. simple or forked low down, bearing 1-4 clusters on erect peduncles: spathes 2-3-fld.: lvs. 3-10 in. a basal tuft, linear, much crisped, hairy at edges: caps. oblong, $\frac{1}{3}$ in. long. Cape Colony.

CC. Plants above 6 in. tall.

D. St. provided with 1 wiry lf. just below infl.

3. *edulis*, Ker. Fls. lilac, spotted yellow: st. naked except for one long wiry lf. from base of infl.: caps. cylindrical. S. Afr. B.M. 613. Var. *odora* has white fls. Var. *longifolia* has yellow fls. B.M. 1238.

DD. Sts. with 1-2 produced lvs. somewhat distant from infl.

E. Fls. lilac.

F. Lvs. above 8 in. long.

4. *tristis*, Ker. Lvs. 2-3, produced near the base, 1-2 ft. long: clusters of fls. 4-6; fls. dull lilac, ochre or salmon-colored, with a yellow spot; style-crests lanceolate: caps. oblong. Cape Colony, southwest district. B.M. 577 (*Iris tristis*).

FF. Lvs. less than 8 in. long.

5. *Thomsonii*, Baker. A rigid herb of rush-like habit: lvs. terete, 6-furrowed; fls. $1\frac{3}{4}$ in. diam. in spicately arranged fascicles; perianth lilac, yellow at base, spotted brown, midribs darker lilac inside, reddish brown outside. E. Trop. Afr. B.M. 7976.

6. *junceæ*, Linn. Fls. lilac, in 2-3 clusters: lvs. 2-3 in. long, falcate, linear complicate: st. very slender, 6-8 in. long: ovary oblong. Cape Colony.

7. *polyanthos*, Thunb. Lvs. about 3, one from near the base of the st., the others from the lower forks, $\frac{1}{2}$ -1 ft. long: clusters of fls. 5-20; fls. lilac: caps. clavate or oblong, $\frac{1}{3}$ - $\frac{1}{2}$ in. long. Cape Colony, northward to Transvaal.

EE. Fls. bright yellow.

8. *revoluta*, C. H. Wright. Closely allied to *M. spathacea*: sepals revolute; styles crested, crossed like closed tips of wings of some birds; fls. solitary; petals oblanceolate, $2\frac{1}{2}$ in. long, bright yellow. Angola.

9. *spathæa*, Ker. Lvs. 1 only produced, strongly ribbed, $1\frac{1}{2}$ -2 ft. long: st. stout, 2-3 ft. long: spathes 2-4-fld.; perianth bright yellow; crests large, lanceolate. Cape Colony. B.M. 6174 (*Diets Huttoni*).

BB. Inner segms. inconspicuous.

C. Color of fls. chiefly orange-red.

10. *Pavonia*, Ker (*Iris Pavonia*, Linn. f.). Outer segms. without a distinct claw, orange-red, with a blue-black or greenish black spot at the glabrous base: lvs. narrow, linear, usually pilose: spathe-valves scarious at the tip. B.M. 1247. Var. *villôsa*, Ker (*Iris villôsa*, Ker). Lvs. pilose: outer segms. bright purple, with a blue-black spot and a hairy claw. B.M. 571 (*Iris villosa*). Var. *lutea*, Baker. Lvs. glabrous: fls. yellow, unspotted. B.M. 772 (*Moræa tricuspis* var. *lutea*). Cape Colony, southwest district.—In *M. Pavonia* and *M. glaucopsis* the inner segms. have a large central cusp and 2 lateral lobes, while in *M. tricuspis* the inner segms. have 3 large cusps.

CC. Color of fls. chiefly white.

D. Spotted blue.

11. *glaucopsis*, Drap. Outer segms. white, with a blue spot: produced lf. single, long, narrow, linear: st. $1\frac{1}{2}$ -2 ft. long; usually 1-3-branched: caps. clavate: crest large, lanceolate. Cape Colony, southwest district. B.M. 168 (erroneously as *Iris Pavonia*).—In this

species the outer segms. have a short, distinct claw, while *M. Pavonia* has none.

DD. Spotted brown.

12. *tricuspis*, Ker. Outer segms. whitish or lilac, with a purplish spot: produced lf. single, long, firm, narrow: st. 1-2 ft. long, with 2-3 sheath-lvs., usually with 3-4 erect branches: spathe-valves scarious at tip: caps. clavate. Cape Colony, southwest district to Natal. B.M. 696.

AA. Rootstock a rhizome, short, creeping.

B. Color of fls. chiefly white.

C. Height of plant 6-8 ft.

13. *Robinsoniana*, Moore & Muell. (*Iris Robinsoniana*, Muell.). WEDDING IRIS. Rhizome short: lvs. radical, 5-6 ft. long: fl.-st. 5-6 ft. long; fls. laxly corymbose; perianth pure white, outer segms. spotted red and yellow near base; crests short and broad. Lord Howe's Isl., Austral. B.M. 7212. G.F. 4:355; 10:255. J.H. III. 32:569. G.M. 34:569. G.C. 1872:393; III. 9:457.

CC. Height of plant 1-2 ft.

14. *iridioides*, Linn. St. 1-2 ft. long, with many short, sheathing, lanceolate bracts: lvs. in fan-shaped basal rosettes: fls. over 3 in. across, white, marked yellow on claws of outer segms.; style-crests lanceolate, $\frac{1}{4}$ - $\frac{1}{2}$ in. long, marked with blue. In Calif. this species is very satisfactory, blooming once a fortnight from early spring until Nov. S. Afr. B.M. 693. L.B.C. 19:1861 (*Iris crassifolia*). G.C. III. 43:88. G.L. 26:92. Vars. *Macleaii*, Hort., and *prolongata* are garden forms. Var. *Johnsonii*, Hort. Differs from type in having longer lvs., $2\frac{1}{2}$ ft. long, erect, instead of spreading obliquely: fls. 4 in. across. G.C. III. 41:296.

BB. Color of fls. chiefly yellow.

15. *bicolor*, Steud. Habit of *M. iridioides*: fls. 2 in. across, yellow, with beautiful brown spots on the outer segms.; style-crests yellow: lvs. $1\frac{1}{2}$ -2 ft. long: sts. 1-2 ft. long: style-crests small. Cape Colony, southeast district. B.R. 1401. L.B.C. 19:1886. P.M. 9:29 (all as *Iris bicolor*). R.B. 33:21.

M. sintensis, Hort. Fl.-sts. 15 in.; fls. $1\frac{1}{2}$ in. across, golden yellow, spotted and streaked vivid scarlet and orange: seeds abundantly. G.C. III. 51:37. May be the same as *Belemcanda chinensis*, Leman., the blackberry lily.—*M. Sisyrinchium*=*Iris Sisyrinchium*.

WILHELM MILLER.

A. C. HOTTES.†

MORËNIA (G. Moreno, physician and naturalist in Lima). *Palmææ*. Closely akin to *Chamaedorea*, but distinguished by the 3-toothed rather than disk-like or ring-like calyx in the male fl. Species Andine, about a half-dozen, very little known in collections. *M. corallina*, Karst., has an annular slender erect st. to 20 ft. high: lvs. pinnate, the lanceolate straight lfts. about 24 pairs: fls. white becoming pale yellow, slightly sunk in the spadix; petals 3 and stamens 6; berry $\frac{2}{3}$ in. diam., bright pink. Colombia. B.M. 8527. *M. fragrans*, Ruiz & Pav. About 6 ft., graceful: lvs. ovate, the petiole long-sheathing at base; lfts. 1 ft. long, narrow-lanceolate, acuminate, unarmed: spadix nodding, 1 ft. long, the branches white. Peru. B.M. 5492.

MORICÂNDIA (named for Moricand, an Italian botanist). *Crucifera*. A few herbs or little shrubs of the Medit. region, seldom cult., allied to *Brassica*. Erect, very glabrous and glaucous, branching: lvs. entire or pinnatisect: fls. large, purple or rose: pod elongated, on strict pedicels. Only one species is likely to be cult., *M. arvensis*, DC. This is annual or biennial, 12-18 in. high, with entire lvs., the cauline cordate and clasping, the lower ones oblong: fls. terminal, in spring and summer, violet with darker lines, attractive. S. Eu. B.M. 3007. G. 35:707. Seeds sown in early spring give plants blooming in midsummer.

MORINA (Louis Morin, a French botanist, 1636-1715). *Dipsacæ*. Perennial herbs, suitable for borders and rock-gardens.

Somewhat thistle-like or resembling spiny plants of the Labiate, glabrous or pubescent: lvs. opposite or whorled, narrowly oblong or linear, mostly spinous-toothed: fls. whorled in spikes, the whorls with wide lf.-like bracts, and with spinous bracteoles among the



2386. *Morinda citrifolia* branch with leaves, flowers and fruit. Also vertical section of fruit (fruit sometimes larger) and enlarged flower below. ($\times 1/2$)

fls.; calyx 2-lipped, the lips entire or 2-lobed; corolla 5-lobed and somewhat 2-labiate, the tube curved; stamens 2 or 4, and sometimes a sterile one.—About 10 species, in Asia, allied to *Cephalaria* and *Dipsacus*.

A. Fls. mostly white.

Bulleyana, Forr. & Diels (*M. Beesia*, Hort.?). St. 1-2 ft., hairy in stripes: lvs. linear to ovate-lanceolate, spiny-dentate, 5-6 in. long: fls. subcapitate, white or purple; calyx spatheaceous, entire, spinose at mouth. China. Recent.

AA. Fls. yellow.

Coulteriàna, Royle. St. 2-3 ft., more or less hairy: lvs. 6 in. long and less than 1 in. wide, sessile, glabrous, spinous-toothed: fls. yellow, the corolla-tube to $3/4$ in. long; calyx-lobes nearly equal and bifid, sharp or spiny; fertile stamens 2. India, 9,000-13,000 ft. in the Himalayas.

AAA. Fls. pink or purple.

pérscica, Linn. (*M. tircica*, Hal. *M. græca*, Jaub. & Spach). Thistle-like: st. 3-4 ft., pubescent or hairy: lvs. 6 in. long and 1 in. wide, sessile, doubly spinous-toothed, pubescent or glabrous: spikes long, bearing bright pink fls.; calyx-lobes nearly equal, entire or emarginate; fertile stamens 2, the filaments as long as corolla-lobes; corolla-tube to $1\frac{1}{2}$ in. long. Greece to the Himalayas.

longifolia, Wall. St. 3-4 ft., pubescent or hairy: foliage thistle-like; lvs. 6 in. long, 1 in. across: fls. showy, deepening from white in the bud to pink and finally crimson, crowded in dense whorls near the top of st.; calyx-lobes unequal, 2-lobed with obtuse not

spinous lobes; fertile stamens 2, the filaments much shorter than the corolla-lobes. Himalayas, 9,000-14,000 ft. Hardy. June-Aug. Himalayas. B.M. 4092. B.R. 26:36. R.H. 1857, p. 514. G.W. 7, p. 5. H.U. 1, p. 191. J.H. III. 51:127.—Whorl-flower is a catalogue name. A useful plant.

L. H. B.

MORÍNDÁ (Latin, *morus*, mulberry, and *indica*, Indian). *Rubiaceæ*. Woody plants, sometimes seen far South; one species has been planted in southern Florida and southern California.

Shrubs, trees and climbers in Trop. Asia, Austral. and the Pacific Isls., and some in Trop. Amer.; perhaps 60 species now described: lvs. opposite, rarely in 3's: fls. white or crimson, in axillary or terminal, simple, paniced or umbellate heads; corolla-tube short or long, funnelform or salverform; lobes 4-7, coriaceous, valvate in the bud; stamens 4-7, usually 5, the filaments adnate to throat of corolla; ovary 2-4-celled, the styles united: fr. an aggregate of the ovaries, or berries, in the head.—Some of the species yield dyes. The frs. of some of them are edible. One species, *M. Roic*, Linn., is native in Fla., extending to the W. Indies; it is a branching shrub with prostrate or somewhat climbing sts.

citrifolia, Linn. **INDIAN MULBERRY**. Fig. 2386. A small tree, with smooth bark and obtusely 4-angled branches: lvs. short-petioled, to 10 in. long, broadly elliptic, shining, acute or obtuse; stipules large, broadly oblong or semi-lunar: fl.-head on solitary peduncles 1 in. long usually in the axil of every other pair of lvs. or lf.-opposed; calyx-limb truncate; corolla 5-lobed, tube about $1/2$ in. long: fr. yellowish, fleshy, globose or ovoid, about 1 in. diam. Probably India; also Malay Archipelago to Austral. and islands. G.C. II. 11:333.—The fls. contain a red and the roots a yellow coloring principle.

Var. bracteàta, Hook. Stipules more acute; calyx-limb often with a lanceolate or spatulate white leafy lobe, sometimes 3 in. long.

M. B. COULSTON.

L. H. B.†

MORÍNGA (altered from the native Malabar name). *Moringacæ*. Trees of warm countries, one of which is run wild in W. Indies and planted in southernmost parts of the United States.

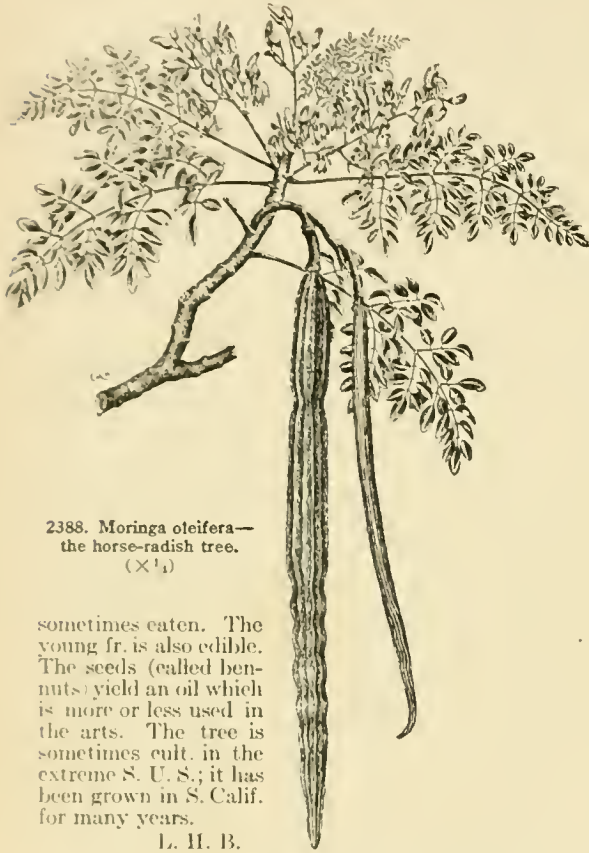
Flowers perfect, 5-merous; calyx cup-shaped, 5-cleft, the lobes reflexing; petals 5, one of them erect and larger; fertile stamens 5, alternating with 5 or 7 staminodia, the anthers attached on the back, and 1-loculed: fr. a long, 4-9-angled, 1-loculed pod with 3 valves, the seeds immersed in the spongy contents of the valves.—Only three species comprise the family *Moringacæ*, all members of the genus *Moringa*. They are small spineless trees, with alternate deciduous pinnate lvs., axillary panicles of rather large, white or red fls., and long pod-like frs. They are native of N. Afr. and the tropical parts of Asia. The position of the family *Moringacæ* is difficult to determine. Benthams & Hooker ally it with *Anardiaceæ*. Engler & Prantl place it between *Resedaceæ* and *Sarraceniacæ*. Grisebach joins it to the *Capparidacæ*. Others ally it with the *Leguminosæ*, which it resembles in external appearance.

oleifera, Lam. (*M. pterygospérma*, Gaertn.). **HORSE-RADISH TREE**. BEN. Figs. 2387, 2388. Small tree (reaching 25 ft.), with soft wood and corky bark, the young parts pubescent: lvs. mostly 3-pinnate, $3/4$ -2 ft. long, all parts stalked: fls. whitish, stalked, fragrant, 1 in.



2387. *Moringa oleifera*. (About natural size)

across; pod often 1½ ft. long, 9-ribbed, bearing 3-angled, winged seeds. India, but now spontaneous in parts of the W. Indies.—The horse-radish tree is so named from the pungent taste of the root, which is



2388. *Moringa oleifera*—
the horse-radish tree.
(× 1/4)

sometimes eaten. The young fr. is also edible. The seeds (called ben-nuts) yield an oil which is more or less used in the arts. The tree is sometimes cult. in the extreme S. U. S.; it has been grown in S. Calif. for many years.

L. H. B.

MORÍSIA (G. G. Moris, 1796–1869, Italian botanist). *Crucifera*. One perennial, excellent in alpine gardening, from Corsica and Sardinia, *M. hypogæa*, Gay. Fig. 2389. Sts. short or none, the underground part spreading horizontally and sending up many linear, pinnatisect or pinnatifid lvs. 3 in. long; fls. golden yellow, in spring and early summer, solitary but numerous and large (¾ in. diam.); sepals erect, linear-oblong and obtuse; petals spatulate; scape decurving and burying the fr., the latter ½ in. or more long and ripening under ground. B.M. 7598. G. 34:323.

L. H. B.

MORISÏONIA (Robert Morison, British botanist, 1628–1683). *Capparidæacæ*. Woody plants of very few species, in the West Indies and South America, one of which is listed abroad: a warmhouse subject, grown for its bloom.

Plants unarmed: lvs. simple, petioled, coriaceous; fls. in many-fl'd. axillary or terminal clusters, large or small; calyx tubular or campanulate, splitting; corolla of 4 obtuse petals; stamens 6–20, shorter or longer than the corolla, with subulate filaments; ovary 4-celled, stalked; fr. a globose berry. *M. americana*, Linn. Low tree: lvs. oblong, at first with lepidote scales, shining, about 6 in. long; fls. white, petals and the infl. scurfy; berry 1½–2 in. diam. W. Indies, Colombia. L. H. B.

MORMODES (Greek, a grotesque creature). *Orchidæacæ*. Rather large plants remarkable for the interesting form of their flowers, which suggested the name given to the genus by Lindley.

Pseudobulbs long, tapering, sheathed by the dry bases of the fallen lvs.; lvs. long, plaited, deciduous in the autumn; raceme from the base of the pseudobulbs, bearing many showy fls.; sepals and petals subequal, mostly narrow; labellum firmly united with the column, with revolute margins, rarely concave, turned to one side; column without appendages, twisted in the opposite direction from the labellum. Distinguished from the closely related genus *Catasetum* by its perfect fls. and wingless column.—About 20 species in Colombia, Cent. Amer. and Mex.

Mormodes are commonly found in poor condition among the collections, which is the result of neglect rather than difficulty of cultivation. They should be grown in small baskets suspended from the roof, in a compost of equal parts of clean chopped peat fiber, sphagnum and soil, interspersed by nodules of charcoal, and the whole pressed in firmly around the roots. The roots like to work among the charcoal, and this also serves the purpose of dividing the compost, thereby allowing it to dry out more readily. Mormodes do not require an abundance of water at any time, and the compost should be allowed to dry out frequently during the growing season. When at rest, an occasional application will suffice to keep the soil moist and the pseudobulbs from shriveling. Re-basketing should take place at the commencement of new growth in spring. They all require warmhouse temperature; the cattleya or cypripedium department affords them a proper location as to temperature and moisture. (Robert M. Grey.)

Colóssus, Reichb. f. Pseudobulbs 6–12 in. long, clothed with brown sheaths; lvs. elliptic-ovate, 10–15 in. long, plaited; raceme inclined, 2 ft. long, with the stalk; fls. 5–6 in. across; sepals and petals narrow-lanceolate, spreading or reflexed, with recurved margins, pink below, changing to yellow toward the upper portion; labellum ovate, long-acuminate, very revolute, yellow, somewhat sprinkled with pink dots. March. Cent. Amer. B.M. 5840.—A plant of striking appearance.

pardina, Batem. Pseudobulbs 4–7 in. high, st.-like, sheathed by the bases of the lanceolate, striate lvs., which are 4 times as long; raceme nodding, many-fl'd., shorter than the lvs.; fls. yellow, spotted with reddish purple, fragrant, crowded on the upper end of the stalk; sepals and petals ovate, pointed, convergent; labellum nearly like the segms. but with 2 lateral acute lobes. July, Aug. Mex. B.M. 3900. F.C. 3:113.—A curious and rather rare plant. Var. *unicolor*, Hook. (*M. citrina*, Hort.). Fls. of one color, all yellow. B.M. 3879. L.H. 1:25. G.C. III. 14:181. Var. *aurantiaca*, Rolfe. Sepals and petals golden yellow; labellum yellow. L.H. 39:144.

Buccinátor, Lindl. Plants 1–2 ft. high; lvs. lanceolate, membranous, striate; fls. pale green, with an



2389. *Morisia hypogæa*. (× 1/2)

ivory-white lip; sepals linear-oblong, the lateral ones reflexed; petals erect; labellum subrotund-cuneate, with the sides rolled back, giving it the appearance of a trumpet. April. Mex. B.M. 4455 (*M. lentiginosa*). Var. *aurantiaca*, Rolfe. Differs in its golden fls. B.M. 8041. Var. *Rölfei*, Hort. Sepals and petals

bronz green; labellum rosy crimson.—This plant is extremely variable in color, ranging from nearly white to chocolate-brown, the various forms being either spotted or plain. Its forms have been described under at least 7 distinct specific names.

luxata, Lindl. Pseudobulbs 4–6 in. long; sheathing lvs. 1–2 ft. long, narrow-lanceolate, plaited; raceme much shorter; fls. 2 in. diam., rather fleshy and globular, lemon-yellow, with a dark brown streak down the labellum; sepals ovate-lanceolate; petals oblong, concave; labellum hemispherical, concave, obsoletely 3-lobed. July. Mex. B.R. 29:33. R.H. 1889:132.—Very fragrant. The fls. are remarkably distorted. Var. *ebúrnea*, Hort. Fls. creamy white. This is a very effective plant, superior to the type. G.C. II. 18:145. I.H. 34:35.

M. Oberlanderianum, Lehm & Kränzl. Sepals and petals lemon-color, rose-spotted; lip apricot, with large spots of same color. N. S. Amer. G.C. III. 28:318.—*M. revolutum*, Rolfe. Fls. cinnamon, with a yellow lip; sepals and petals lanceolate, acute or acuminate; lip 3-lobed, the midlobe acuminate, reflexed. Peru. B.M. 8390.—*M. Wolterianum*, Kränzl. Resembling *M. Buccinator*: racemes up to 10-fl.; fls. orange-brown. Peru.

HEINRICH HASSELBRING.
GEORGE V. NASH.†

MORMÓLYCE (a *bugbear* or *phantom*, probably referring to shape of flowers). *Orchidaceæ*. One Mexican epiphytic orchid, *M. ringens*, Fenzl (*Trigonidium ringens*, Lindl.), of the *Maxillaria* group; rhizome creeping; st. very short, with 1 coriaceous rather long lf. from a globose pseudobulb; scape leafless, slender, with 1 medium-sized yellowish green inodorous fl.; sepals spreading; labellum with erect lateral lobes and short middle lobe; column incurved; pollinia 4, ovoid.

MORNING-GLORY: *Ipomœa*.

MORRËNIA (Professor Charles Morren, Belgian botanist). *Asclepiadaceæ*. Two pubescent twining shrubs of S. Amer., allied to *Cynanchum*, but differing



2390. Staminate catkin of Russian mulberry. (Natural size)

2391. Pistillate catkin of Russian mulberry. (Natural size)

in its convex 2-lobed stigma (flat or concave in *Cynanchum*) and the tubular corona, which is longer than the pistils, villose on the inside, and conniving over the pistils. A few other species have been added more recently. The lvs. are opposite and hastate. *M. odorata*, Lindl., is more or less in cult., and is listed in S. Calif. It has white very fragrant fls. in dense cymes in the axils; sepals 5, linear; corolla rotate, the lobes wide-spreading and acuminate; corona tubular, 5-lobed. Argentina and Paraguay. Has merit for the agreeable vanilla fragrance of its inconspicuous fls. H.U. 5, p. 129. *M. brachystephana*, Griseb., is a climber from Argentina with ovate, acuminate, hastate or cordate lvs., and loose axillary cymes of pure white star-shaped vanilla-scented fls.

L. H. B.

MÔRUS (the ancient Latin name). *Moraceæ*. MULBERRY. Ornamental and fruit-bearing small trees.

Unarmed, fls. diœcious or monoœcious, both sexes in small hanging axillary catkins, the males soon falling (Figs. 2390, 2391); calyx 4-parted; stamens 4, the filaments partially inclosed in the calyx-lobes (Fig. 2392): pistillate fl. with one 2-celled ovary and 2 stigmas, and the 4 calyx-lobes adherent to the ovary (Fig. 2393) becoming fleshy and cohering into a long multiple fr. which suggests a blackberry in external appearance

(Fig. 2394): real fr. an ovate compressed little achene, covered in the pulpy mass, 1 for every fertile fl. represented in the aggregate fr.—Temperate regions of the Old and New World. About 100 species of *Morus* have been described, but Bureau, DC. Prodr. 17:237 (1873)



2392. Staminate flower of Russian mulberry. (Enlarged)



2393. Pistillate flower of Russian mulberry. (Enlarged)

reduces them to 5; probably 10 or a dozen species represent the genus as now known. Two species are native in the U. S. Some of the names are now referred to other genera. Many of the names represent cultural forms of *M. alba*.

Mulberries are grown as food for silkworms and for the edible fruits. The silkworm mulberry of history is *M. alba*, and the fruit-bearing mulberry of history is *M. nigra*. Yet, strangely enough, the leading fruit-bearing varieties of North America, are derived from *M. alba* (see Bailey, Bulletin No. 21, Cornell Experiment Station, and "Evolution of Our Native Fruits"). The native *M. rubra* has also given varieties which are grown for their fruits. The silkworm mulberry of the Chinese is *M. multicaulis*, by some considered to be a form of *M. alba*. This was introduced into North America early in last century, and for a time there was the wildest speculation in the selling and planting of the mulberry tree, and in the rearing of silkworms. These efforts have now largely passed away in North America. *M. multicaulis* gave rise to one variety which was prized for its fruits, the Downing. This variety is now little known, but the name has been popularly but erroneously transferred to a good variety of *M. alba* (the New American).

In North America the mulberry is known chiefly as a fruit-bearing tree, although it is never planted extensively and the fruit is scarcely known in the market. Two or three trees about the home grounds are sufficient to supply a family. The fruits are sweet and soft. To many persons they are too sweet. Because of their sweetness they are of little value for culinary uses. They usually drop when ripe. They are harvested by being shaken on sheets or straw. Birds are exceedingly fond of them. In the East and North, varieties of *M. alba* are chiefly grown, as the New American (frequently cultivated as Downing), Thorburn and Trowbridge. On the Pacific coast and in some parts of the South, varieties of *M. nigra* are grown, particularly the Black Persian. In parts of the South forms of the native *M. rubra* are grown, as Hicks and Stubbs. These are popular for planting in hog pastures, as the animals like the fruits. The mulberry thrives in any garden soil. It does well even on thin gravels and rocky slopes. For fruit-bearing purposes, trees may be planted from 20 to 40 feet apart.

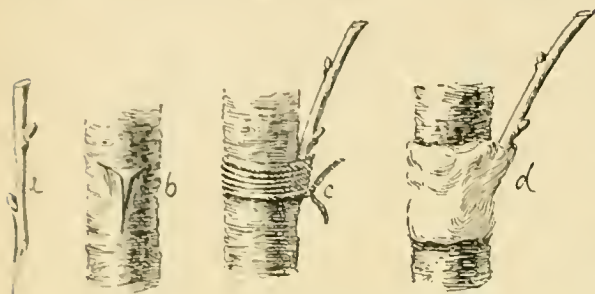
The Russian mulberries are offshoots of *M. alba*. Their particular merits are great hardiness to withstand cold, drought and neglect. They are useful for low windbreaks and also for sheared hedges. They have become popular on the Plains. They are readily propagated by seeds, and the resulting plants are variable. Now and then a large-fruited form appears and it may be named and propagated, but for the most part the Russian mulberry



2394. Fruit of *Morus alba*. (Natural size)

has little merit for its fruits unless one desires to feed the birds.

Varieties of mulberries are now readily worked on seedlings of the Russian. One of the most successful grafts is S. D. Willard's method, shown in Fig. 2395.



2395. A method of grafting the mulberry. *a*, the cion; *b*, matrix to receive cion; *c*, the graft tied; *d*, the graft waxed.

The grafting is performed in spring when the bark will slip, using cions which have been kept perfectly dormant or on ice; *a* is the cion, the lower part being cut thin so that it will enter readily between the bark and wood of the stock; *b* is the stock, with an incision made through the bark essentially as for shield-budding; *c* shows the graft bound with cord or raffia; *d* shows the completed operation, the work being covered with wax.

Morus multicaulis grows from cuttings in the South. These cuttings, with the buds removed to prevent sprouting, are often grafted before they are planted with a long cion of the desired variety (see Fig. 1691). The cutting acts as a nurse, and the cion takes root of itself if set deep enough.

There are many mulberries with ornamental forms. Of these, the most popular in America at present is Teas' weeping, a chance seedling of the Russian mulberry tribe. When grafted several feet high on straight Russian stock, it makes one of the best of small weeping lawn trees (Fig. 2396). It originated on the grounds of John C. Teas, Carthage, Missouri, about 1883. Various cut-leaved forms, mostly of *M. alba*, are seen in fine collections, of which the form known as *M. venosa* (Fig. 2397) is one of the best. The foliage of mulberries is interesting because so variable. Even on the same tree there may be leaves of several forms, while different trees of the same species may show strong individual traits. The most striking variations are in the lobing of the leaves.

A. Lvs. mostly bright and glabrous above, and usually glossy.

B. Style very short or practically none.

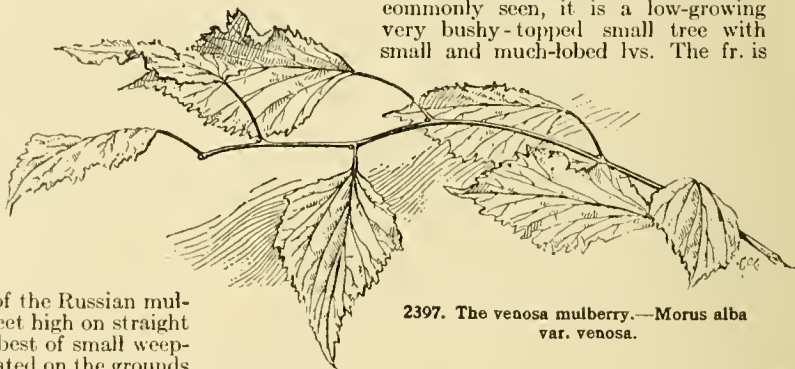


2396. Teas' weeping mulberry.

alba, Linn. WHITE MULBERRY. Figs. 2398, 2399 *B.* Lvs. light green, rather small, smooth or very nearly so above and often shining, the veins prominent beneath and whitish, variously lobed or divided, the basal lobes unequal, the teeth large and for the most part rounded or nearly obtuse, the branches gray or grayish yellow; fr. variable, usually narrow, 1-2 in. long, white or violet,

very sweet. China.—*Morus alba* has been cult. from the earliest times, chiefly for feeding the silk-worm. It is a frequent tree along roadsides and in the old yards in the eastern states, where the trunk sometimes attains a diam. of 2 ft. This half-wild form usually has rather small rounded shining lvs. with very large rounded teeth, and bears small whitish or violet frs. which are very sweet. Sometimes the frs. are an inch long, but they are oftener only half that length, and one sometimes finds trees on which the frs. are barely $\frac{1}{4}$ in. long. Now and then a tree bears fr. nearly or quite black. Birds, poultry and hogs are fond of these mulberries. The trees are usually very thick-topped and bushy growers, but sometimes one is seen which, when young, has branches as straight and trim as a Northern Spy apple. These half-wild trees are seedlings, and this accounts for their variability. Var. *péndula*, Dipp. Branches slender, drooping. Var. *pyramidalis*, Ser. (var. *fastigiata*, Schelle). Tree of pyramidal form: lvs. acute, usually lobed. Var. *laciniata*, Beissn. (var. *skeletoniana*, Schneid.) SKELETON-LEAVED MULBERRY. Lvs. regularly and deeply divided into narrow lobes, the terminal lobe and usually two of the lateral ones with very long points; a distinct and graceful form.

Var. *tatárica*, Loudon (*M. tatárica*, Linn.). RUSSIAN MULBERRY. Fig. 2400. A hardy type of *M. alba* which was intro. into our western states in 1875-77 by the Russian Mennonites. It differs little from the type of *M. alba* in botanical characters. As commonly seen, it is a low-growing very bushy-topped small tree with small and much-lobed lvs. The fr. is



2397. The venosa mulberry.—*Morus alba* var. *venosa*.

usually very small and insipid, and varies from creamy white to violet, and almost black.

Var. *venôsa*, Del. (var. *nervôsa*, Lodd. Var. *fibrôsa*, Ser. *M. urticafolia*, Hort.). Fig. 2397. Lvs. contracted and jagged, and very strongly marked with many white veins. It bears fr. $\frac{1}{2}$ in. long. Among the horticultural curiosities this tree should find a place, although it is not grown by our nurserymen. Its ornamental value is considerable, especially when striking effects are desired. Rare in Amer. The history of this mulberry is obscure. Delile described it in a French report as long ago as 1826; of horticultural origin.

The variations of this species allow of many Latin names to be applied. The following names, which one may find in horticultural literature, are referable to *M. alba*: *byzantina*, *cedrona*(?), *colombassa*, *constantinopolitana*, *Fegyvernekiana*, *globosa*, *intermedia*, *italica*, *laciniata* (of some), *lucida*, *membranacea*, *macrophylla*, *Morettii*, *Morettiana*, *romana*, *rosea*.

bn. Style evident or even prominent.

japónica, Audih. (*M. alba* var. *stylôsa*, Bureau). Lvs. usually large, dull, rather thin, long-pointed, the rounded teeth very large and deep, or the margin even almost jagged, the lvs. upon the young growth usually deeply lobed. China, Korea, Japan.—This species has been intro. into this country, but apparently is not much known. It is tender in the N. when young. The fr. is described as short-oblong and red.

2398. *Morus alba*. ($\times \frac{1}{4}$)

AA. Lvs. dull green, mostly rough or pubescent.

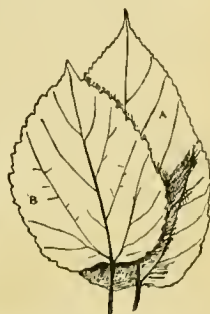
B. Full-grown lvs. more than 4 in. long.

multicaulis, Perr. (*M. alba* var. *multicaulis*, Loud. *M. alba* var. *latifolia*, Bureau. *M. sinensis*, Hort. *M. latifolia*, Poir., which Bureau refers here, is probably *M. indica*, Linn.). Fig. 2399A. A strong-growing small tree or giant shrub, with dull roughish and very large long-pointed lvs., which are seldom or never prominently lobed, and which are often convex above, bearing black sweet fr.: style evident. China, where it is apparently the chief silkworm mulberry.—Once much grown in this country, but not now well known, particularly not in the N.

nigra, Linn. **BLACK MULBERRY**. Lvs. dark, dull green, rather large, tapering into a prominent point, commonly very rough above, usually not lobed, the base equal or very nearly so on both sides, the teeth rather small and close, the branches brown: fr. large, comparatively thick and fleshy, mostly dark-colored. The black mulberry is a native of Asia, probably of Persia and adjacent regions.—This is the species which is cult. in the Old World for its fr. In Amer. it is very little grown, although run wild now and then about grounds and along roadsides. It is not hardy, except in protected places, in New England and N. Y. The Black Persian mulberry of the S. and of Calif. is probably of this species.

rubra, Linn. **NATIVE RED MULBERRY**. Fig. 2401. Lvs. usually large, very various, those on the young shoots deeply lobed with very oblique and rounded sinuses in the base of which there are no teeth, the upper surface rough and the lower one soft or variously pubescent, the teeth medium or comparatively small and either rounded or bluntish: fr. deep red, or when fully ripe almost black, variable in size, often very good, nearly always having an agreeable slight acidity. Mass. to Fla., Kans. and Texas, mostly in rich soils and bottom lands. S.S. 7:320.—This native mulberry has been tried for the feeding of silkworms, but with indifferent

success. At least 3 of the named fr.-bearing mulberries belong to it, and a yellow-lvd. mulberry, which is somewhat grown for ornament, also appears to be of this species. The characteristic lobing of lvs. on the young growth is shown in the upper spray of Fig. 2401. The nearest approach to this lobing is in the Japanese (*Morus japonica*), and this affords another of those interesting parallelisms which exist between the Japanese and E. American floras. The red mulberry is the largest tree of the genus. In the S. it often attains a height of 70 ft. and a diam. of 3 or 4 ft. The timber is used for posts and light woodwork. Var. *tomentosa*, Bureau (*M. tomentosa*, Raf.). Lvs. very soft-pubescent and whitish beneath, often glossy but rough above. Texas.—A large-fruited form of this was intro. in 1889 by T. V. Munson as the Lampasas mulberry.



2399. Leaf of *Morus alba* at B; of *M. multicaulis* at A.

BB. Full-grown lvs. usually 3 in. or less long.

celtidifolia, HBK. (*M. mexicana*, Benth. *M. microphylla*, Buekl.). Much smaller tree than *M. rubra*, rarely more than 25 ft. tall, and with smaller and smoother lvs. and smaller, sourer black fr., which ripens earlier and is not so good: lvs. cordate-ovate, more or less lobed, mucronate-serrate, nearly smooth on both sides: fr. short-ovate or sometimes nearly globose. Texas and Ariz. to Peru. S.S. 7:321.—Occasionally planted for its frs.

L. H. B.

MOSCHÓSMA (from the musk-like odor). *Labiatae*.

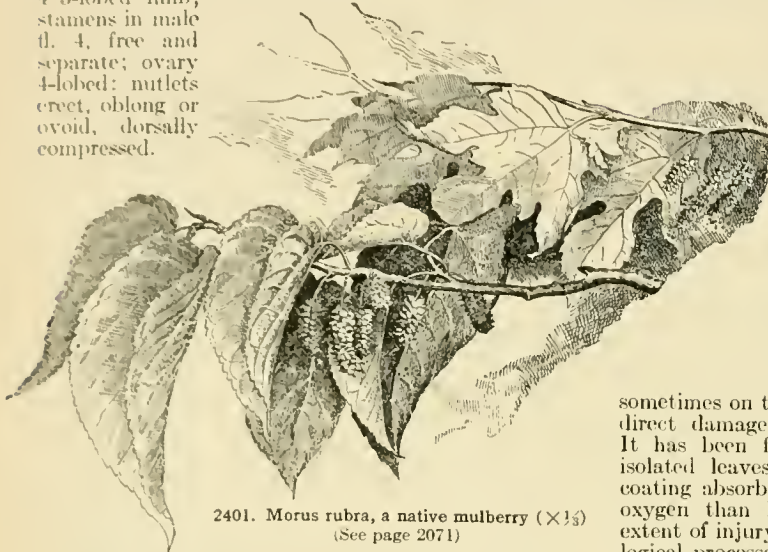
In recent years there has come into prominence in European gardens a showy-flowered small shrub or tall herb from tropical and southern Africa under the name *Moschosma riparium*, but which N. E. Brown now refers to Iboza. The plants belonging to Iboza,



2400. Russian mulberry.—*Morus alba* var. *tatarica*. ($\times \frac{1}{4}$)

Brown writes, "have hitherto been referred to *Moschosma*, but they differ entirely from that genus in habit, calyx and corolla, and in having unisexual flowers, with the sexes on different plants. The small size and form of the corolla and the arrangement and spread of the stamens is somewhat like that of *Mentha*," next which he considers this genus should be placed.

Iboza (Kafir name of *I. riparia*) has more than a dozen species in S. and Trop. Afr.: fls. very small, dioecious, the males larger and bearing an abortive ovary or style; calyx minute, 3-lobed; corolla very small, with funnelform tube and more or less unequally 4-5-lobed limb; stamens in male fl. 4, free and separate; ovary 4-lobed; nutlets erect, oblong or ovoid, dorsally compressed.



2401. *Morus rubra*, a native mulberry ($\times \frac{1}{3}$)
(See page 2071)

Ibôza riparia, N. E. Br., or *Moschósma riparium*, Hochst. Stout, 2-5 ft., perennial, the st. branching and obtusely 4-angled; lvs. broadly ovate, most of them notched at base and otherwise toothed; fls. very numerous, in erect panicles above the foliage and therefore conspicuous although small, creamy white with dark anthers. G.C. III. 31:122; 35:31. Gn. 61, p. 121; 65, p. 37; 69, p. 69. Gn.W. 20:90. G. 24:30.—An excellent bloomer under glass Dec.-Feb. After blooming, the plants may be cut back and good shoots secured for cuttings for the next winter's bloom. It is handled much like *salvias* and the species of *coleus*.

L. H. B.

MOSS. A general name for many humble green plants of the cryptogamia (so-called flowerless plants), mostly with distinct stems and foliage leaves. In North America there are about 1,000 species, distributed in various families. They have solitary, or rarely clustered, mostly stalked spore-cases or capsules arising from the apex or side of a leafy stem (Fig. 2402). The capsule is covered with a thin cap or calyptra (*c*) which is shed at maturity. The capsule opens by means of a lid or operculum (*o*), and the orifice is usually guarded by one or two rows of teeth, or peristome. A fuller discussion of the structure and relationships of the mosses will be found in Volume 1, on page 6. The mosses are not horticultural plants. *Sphagnum* moss is much used as a packing material and for holding moisture about pots, and as a medium in which to sow delicate seeds, but it is collected from bogs and not grown for the purpose. Club-mosses are not true mosses but lycopodiums (see *Lycopodium* and *Selaginella*). The "moss" on fruit and other trees is mostly lichen. The Florida or Spanish moss is a flowering plant (see *Tillandsia*).

MOSS PINK: *Phlox subulata*.

MOULDS, MOLD. The term mould is applied to any small fungous growth which appears on decaying organic matter, such as fruits, both fresh and preserved, vegetables, and so on. The moulds are very simple fungi producing immense numbers of spores, a fact which accounts for their presence everywhere, in the air, in dust, and on all exposed bodies. As a rule, these fungi are not directly injurious to plants; they are normally saprophytes and perform a great service in disorganizing organic matter which would otherwise accumulate on the earth. A few of the species may become parasitic. Thus, species of *Botrytis*

often attack lettuce in forcing-houses which are too close and damp. Carnation buds and violet plants are also frequently injured by *Botrytis*. The mould-like growths occurring on boards in damp cellars or in greenhouse benches are sterile mycelia of higher fungi. These do not attack plants, but sometimes, as in the case of violets, grow over and smother the plants. The so-called sooty moulds constitute the small family of the *Perisporiaceae*. They receive their name from the fact that they form dark olive-green or black coatings on the twigs and leaves of plants on which they grow. They are not parasitic but live for the most part on the honey-dew secreted by insects and

sometimes on the insects themselves. Apparently little direct damage is caused to plants by these fungi. It has been found in laboratory experiments with isolated leaves that those freed from the fungous coating absorb more carbon-dioxide and liberate more oxygen than leaves coated with the fungus. The extent of injury arising from interference with physiological processes on account of shading and the possible closing of the stomata under natural conditions has not been generally determined, but it is certain that orange and lemon trees sometimes suffer serious injury, in fruit and foliage, brought about in this way. The sooty moulds are mostly confined to tropical and subtropical regions where they are abundant on many kinds of plants. They occur occasionally in greenhouses on coriaceous-leaved coolhouse plants, such as oleander and evonymus, which were formerly more generally grown. With the advent of present-day heating systems and the introduction of the practice of growing rapidly shifting crops, these fungi, never of great significance, have practically disappeared from greenhouses. The following are among the more common forms of sooty moulds: *Dimerosporium mangifera*, on mango; *D. pulchrum*, on privet, *loniceera* and *cornus*; *Apiosporium salicinum*, common on leaves of woody plants; *A. Footii*, on greenhouse plants; *Capnodium fadum*, on oleander; *C. guajava* on guava and other tropical shrubs and trees; *Meliola Penzigi* causes considerable injury to citrus trees in Florida by coating the leaves and fruit. The numerous forms occurring in the tropics have not been fully investigated. See, also, *Diseases and Fungi*.

HEINRICH HASSELBRING.

MOUNTAIN-ASH: *Sorbus Aucuparia*. **M.-Ebony:** *Bauhinia*. **M.-Laurel:** *Kalmia*, particularly *K. latifolia*. **M.-Mahoe:** *Hibiscus elatus*. **M.-Mahogany:** *Cercocarpus*. **M.-Mint:** *Pycnanthemum*. **M.-Rose:** *Antigonon*.

MOURNING BRIDE: *Scabiosa*.

MOVING PLANT: *Desmodium gyrans*.

MUCKLAND-GARDENING. In recent years there has been a large development of truck-gardening in swamps, bogs and similar areas that have been drained and improved. These areas have deep black

soil, very adaptable to onions, lettuce, celery and certain other crops, and special methods have been developed on them, so much so that muckland-gardening has become almost a special department of horticultural operations.

Location.

One should be careful in selecting muck, as poor muck will not yield paying crops. A patch of muck that can be drained so that the water-table will be $2\frac{1}{2}$ feet from the surface, is most desirable. It should be so located that a running stream of water will flow through or near the muck, which will keep it moist during a dry spell. Never buy any new muckland for gardening purposes if it is not covered with a good crop of timber or weeds. Muck covered with a thrifty growth of elm, black ash, and soft maple, will give good crops when brought under cultivation. Cedar and spruce muck are not so good for all kinds of muckland crops. If a muck tract has been cleared from timber and is not cultivated, it should grow a very thrifty crop of swamp weeds; if it does not show a good growth of weeds it should be avoided.

Endeavor to locate near a railroad or on a good improved highway. Good mucklands yield large and bulky crops and the cost of long hauls to market or the railroad will be very high. In a few years the extra expense of drawing the crops to market will exceed the first cost of the muck itself. It is also advantageous to locate where one can ship on several good railroads. It will give a wider range of markets and a lower freight rate.

It is well to have the muck-garden near a large body of water. Muckland so located has a much longer growing season. The water warms the air during the cold nights in the fall, and many times saves the entire crop from a frost. It also cools the very hot air during the midsummer.

Clearing and preparing for cropping.

If the muckland is covered with a heavy growth of timber, it should be cut down and the stumps removed. There are many ways of clearing and removing the stumps, either dynamite or stump-pullers working very well. The holes should be filled up before plowing, and all the roots that the plow comes in contact with removed. A good disc-plow does better work on

newly cleared land, as the small roots will not clog a disc as they do a moldboard plow. Corn is a good crop to which to plant new muckland, as it will grow well and helps greatly to subdue the land. The following year the land may be planted to garden crops providing it has been well cultivated while the corn was growing, and carefully prepared and fitted to receive the muck crops.

Drainage.

All mucklands must have good drainage or they will not yield paying crops. The water-table should be $2\frac{1}{2}$ feet from the surface to give best results. In order that the water may be lowered to the same level throughout the tract, it will be necessary to construct main and lateral ditches. The latter should be placed from 5 to 10 rods apart, according to the condition of the muck. If the muck is coarse and fibrous, the lateral ditches may be placed farther apart; if it has reached a more advanced stage of

decay so that it is fine and pulverized, the lateral ditches must be placed closer together. If the natural fall in the main ditch is not sufficient to give ample drainage and the water-shed from the uplands is not too great, artificial drainage can be installed and will prove very profitable. The water should be led to the lowest point in the main ditch and a pumping-station installed, with which the water is elevated. When artificial drainage is used, the land should be surrounded by a good dyke and should have a ditch all around the muck on the inside of the dyke leading to the pumping-station. There are many muck-gardens operated by this system of drainage that are producing good crops. They are not affected by a drought as are the higher located muck-gardens. The expense for power is not very high, if one has a good outfit for pumping.

Fertilizers.

All mucklands in the northern states are very rich in organic matter, fairly well supplied with phosphoric acid and low in potash, and very high in nitrogen. Samples of muck taken from various sections show by analysis that they contain materials as follows:

Organic matter.....	from	82.5	to	88.7	per cent.
Nitrogen.....	from	1.8	to	2.42	per cent.
Phosphoric acid.....	from	.27	to	1.9	per cent.
Potash.....	from	.15	to	.26	per cent.
Calcium-oxide.....	from	4.2	to	6.3	per cent.

However, the plant-food found in muck is not available to garden crops in large enough quantities to warrant the growing of such crops without the use of commercial fertilizer or stable-manures. When muckland is brought under cultivation, it renders some of the plant-food available to the crops, but it would mean failure to any grower if he did not use fertilizer of some kind each year. A brand of fertilizer containing about 2 per cent nitrogen, 8 per cent available phosphoric acid and 10 per cent potash, is a good mixture with which to start the crop. If the growth is not fast enough after the crop is well started, apply nitrate of soda. By watching the growth of the crop, one will soon learn what to apply.

Many growers apply about 1,000 pounds of 2:8:10 fertilizer to the acre in the spring just before the crop is planted and work it well into the soil and then apply from 400 to 1,000 pounds during the growing season. Some growers prefer to apply all the phosphoric acid and potash in the spring and then feed the crop on nitrogen alone during the growing season, using nitrate of soda, dried blood and tankage. Not more than 400 pounds of nitrate of soda to the acre is used at one time, unless the ground is very cold and wet in early spring. Such crops as onions, lettuce, carrots and beets do not need such large amounts. Spinach will respond greatly to a liberal application of nitrate of soda. One grower has raised sixteen tons of spinach to the acre and harvested the crop by June 8 by applying 800 pounds of 2:8:10 to the acre before sowing the seed and 600 pounds of nitrate of soda to the acre when the crop was well started. Twenty-five carloads of celery were also grown on 8 acres by using 3,000 pounds of commercial fertilizer, 4:7:10 brand, before planting, and side-dressing with fish tankage every two weeks, making three applications during the season after the crop had started and using 1,200 pounds of tankage to the acre in the three applications. However, this celery was grown under irrigation. It is not advisable for anyone to use that amount of fertilizer unless he thoroughly understands the health condition of the celery crop, as he may spoil the entire crop by so doing. Such crops as onion and celery should produce a good yield by applying from 1,000 to 2,000 pounds of 2:8:10 to the acre during the season. Lettuce, carrots, beets and potatoes should do well on 600 to 1,000 pounds to the acre. Spinach will do well on 500 pounds of 2:8:10



2402. Hair-cap moss.—*Polytrichum commune*.

and 500 pounds of nitrate of soda to the acre. Never sow spinach on a new muck, as it will not do well.

Vegetable crops adapted to muckland.

The main crops grown on muckland in the north-eastern states are onions, celery, and lettuce, but there are many other crops that yield good returns to the grower. Potatoes grown on muckland are, as a rule, not very good for eating purposes but they make the choicest kind of seed stock. A good business could be worked up on muckland-grown seed potatoes.

Sweet corn grows very well on muck and the yield is large, but it must be grown for canning purposes as the season is not long enough fully to mature the crop. Peas for canning purposes do well. Beets for winter use or for canning while small yield large crops. Carrots yield enormous crops of excellent quality. Parsnips do well on well-drained muck but not unless the water-table is low. Horse-radish grows to perfection and the quality is good. Spinach grows better on old muck than on any other kind of soil, and the quality is far superior to upland spinach, as it is entirely free from grit. Asparagus grows to perfection on well-drained muck but the water-level must be kept down below the crowns during the winter months or it will rot them. Cauliflower grows well on muckland. Cabbage does very well on shallow muck, but is likely to head soft on deep muck. Asters and sweet peas for cut-flowers grow to perfection on muck, and there is a good demand for the blossoms in the large cities. Gladioli grown for bulbs do very well on muck.

Tillage and handling of muckland.

There are many different opinions as to how muck should be tilled. Some growers believe in deep plowing so as to get the best of conditions possible for a good root-growth. However, deep plowing should never be practised in the spring. If virgin muck soil is brought to the surface in spring or summer, it will bake and form lumps much like soft coal, and will not hold the moisture and therefore the crops will not do well. The deep plowing should be done in the fall after the frost has worked on the virgin subsoil which when brought to the top becomes pulverized and will be in fine condition for cropping the next spring. When the frost is out of the ground in the spring, break the soil up thoroughly with a cultivator to a depth of 6 inches, and put on the first application of fertilizer. Work this well into the soil by dragging it three or four times and then go over the land with a leveler, after which the seed is sown.

Deep cultivation in the early spring helps to dry out the soil and warms it up, and causes the roots of the crop to work deeply into the ground. As the crops grow and the weather and soil warm up, cultivation must be continued, but of less depth so that the roots are not cut off. If shallow cultivation is practised at first, the root-growth will all be near the surface and when dry weather sets in, roots will have no moisture and the plants stop growing until they can send roots down into the moist soil. A mulch of dry muck for a depth of 1 or 2 inches will carry the crop through a dry spell in good condition. In wet weather the land should be left in ridges after cultivating, as this helps to dry it. In dry weather, however, it should be left as level as possible in order to hold the moisture.

HENRY GREFFRATH.

MUCUNA (Brazilian name). *Leguminosæ*. Under this name several annual bean-like vines have been grown in the southern states for forage, green-manuring and ornament. The genus, as accepted by the standard works, has recently been divided, however, and the plants cultivated in this country are separated under *Stizolobium* (which see).

Mucuna, as thus re-defined (Bart, Bull. No. 141 Bur. Pl. Ind., U.S. Dept. Agric., and Piper & Tracy, Bull. No.

179, same), is a genus of perennials, whereas *Stizolobium* is annual or essentially so; in *Mucuna*, the hilum on the seed is much elongated and band-like, extending nearly all the way around the seed; in *Stizolobium*, the hilum is linear, elevated and oblong-crateriform, extending from one-fifth to nearly one-fourth of the circumference of the seed; there are also marked differences in germination. As thus restricted, *Mucuna* appears to have no species cult. in this country. L. H. B.

MUEHLENBECKIA (after Dr. Muehlenbeck, a Swiss physician). *Polygonaceæ*. A rather small group of climbing or erect, usually slightly shrubby plants, all inhabitants of the South Temperate Zone.

Leaves alternate, with sheathing stipules at the base: fls. unisexual, small, fasciated in the fl.-axils; perianth with 5 nearly equal lobes; stamens 8; ovary 1-celled, 1-ovuled; styles 3: achene obtuse or acute, 3-angled, crustaceous, about equaling the succulent perianth. Ornamental plants, various in appearance. Species about 15.

A. Stigma fringed.

B. Sts. very flat and broad.

platyclada, Meissn. (*Coccoloba platyclada*, F. Muell.). A very interesting, erect, shrubby plant with broad, flat, ribbon-like, glossy, delicately striate branches replacing the lvs., which are scanty or entirely wanting: lvs. membranous, oblong-lanceolate, sometimes hastate: bracts and stipules very short: fls. white, in few-fl. clusters: achenes included in the fleshy perianth, which at maturity is bright red or at length deep purple and quite showy. Solomon Is. B.M. 5382.—Frequently grown in greenhouses because of the odd flat sts. and showy fr.

BB. Sts. slender and nearly terete: lvs. fiddle-shaped.

varians, Meissn. Somewhat shrubby at base: sts. smooth, herbaceous, filiform, twining; internodes elongated: sheaths white, narrow, 3 lines long: lvs. 1 in. or less long, petioled, ovate, acuminate, deeply lobed at the middle on each side, fiddle-shaped; sinus broad or narrow-obtuse; otherwise entire: racemes axillary, solitary or in 2's, simple or bifid, forming a terminal leafy panicle 3-4 in. long; fls. subsessile, similar to those of *Polygonum aviculare*. Habitat (?).

AA. Stigma papillose.

B. Sts. low, rarely twining: lvs. 3-5 lines long.

compléxa, Meissn. WIRE PLANT. A twining or drooping, somewhat shrubby plant: st. slender and much-branched, glabrous except when very young; lvs. very small, 3-5 lines long, light green, about equaling the petiole, mostly fiddle-shaped, rarely hastate; sheaths small, tubular, deciduous: fls. 1-6, in somewhat racemose, pubescent clusters, green and inconspicuous: fr. with a succulent, transparent, whitish, persistent perianth. New Zeal. B.M. 8449.—A graceful basket plant. Fr.-clusters glistening, showy. It is sometimes called *Polygonum* by florists. A popular high-climbing vine in Calif., on chimneys and elsewhere. Of variable habit.

BB. Sts. coarser, twining, reddish: lvs. larger.

chilénsis, Meissn. Somewhat shrubby, glabrous: branches strongly sulcate, loosely twining, angular, "bright red:" lvs. somewhat fleshy or coriaceous, petioled, triangular or hastate-cordate, ovate, oblong or lanceolate, truncate or attenuate at base, 1-nerved; margin entire, somewhat revolute, smooth: racemes axillary and terminal, solitary, simple, lax and leafless, rarely contracted; bracts about equaling the pedicels: achenes subglobose, 3-angled. Chile and Peru.

M. adpressa, Meissn. Large, diffuse, bushy plant, with small pink fls. in paniculate spikes: lvs. up to 2 in. long, broadly oblong, often cordate, glabrous. Austral. B.M. 3145 (as *Polygonum*).—Cult. in Eu.—*M. nana*, Hort., is said to be a dwarf form. The botanical status is uncertain.

K. M. WIEGAND.

MUHLENBERGIA (Dr. H. Muhlenberg, who wrote a work upon American grasses in 1817). Sometimes spelled *Muchlenbergia*. *Gramineæ*. Spikelets 1-fl.; lemma firm, mucronate or awned. About 60 species, mostly American. *M. racemosa*, BSP. (*M. glomerata*, Trin.). An erect perennial, with rather short appressed lvs.: panicle contracted and spike-like; glumes nearly equal, 1-nerved, extending into short awns; lemma longer than empty glumes, excluding the awns. Dept. Agric., Div. Agrost. 7:109. Wet ground, nearly throughout N. U. S.

A. S. HITCHCOCK.

MUÏLLA (an inversion of *Allium*). *Liliacæ*. Bulbous plants closely allied to *Allium*.

Perianth subrotate, persistent, of 6 nearly equal slightly united segms., spreading, closely 2- to 3-nerved; stamens in one row at the base; anthers versatile; filaments slightly thicker at the base; ovules 8-10 in a cell; style club-shaped, persistent and at length splitting; caps. obovate or subglobose, sessile or nearly so; fls. greenish white; pedicels not jointed; lvs. several.—One species from Calif., W. Nev. An unimportant plant advertised by specialists in Pacific coast bulbs. It has a slender scape 3-12 in. high, bearing early in the year an umbel of 5-15 greenish white fls., each about 1½ in. across. Differs from *Allium*, in that instead of a true bulb it has a fibrous-coated corm, and also lacks the onion-like odor.

maritima, Wats. Lvs. several, not sheathing at base, scabrous, as long as the scape: corm small; caps. ¼ in. long, with usually 3 seeds in each cell. Calif., W. Nev. —Saline regions.

A. C. HOTTES.†

MÜKIA: *Melothria*.

MULBERRY: *Morus*. French M.: *Calli-carpa americana*. Indian M.: *Morinda*. Paper M.: *Broussonetia*. The wild *Rubus odoratus* is improperly called mulberry in some parts of the country.

MULCHING is the covering of the soil or earth with some protecting material. It has six or more general objects: (1) to conserve moisture by preventing or hindering evaporation; (2) to protect plants from winter injury; (3) to keep the surface of the soil loose and friable; (4) to add plant-food to the soil; (5) to protect berries or flowers from dirt spattered up by rain, as in the case of strawberries; (6) to keep down weeds.

The moisture available to agricultural plants is held in the soil by means of capillary or film attraction. The soil may be conceived to be full of irregular capillary tubes or connecting interstices which have a general vertical direction. The upper ends of these spaces are in contact with the atmosphere, and they are constantly giving off moisture into the air. If the upper openings of these interstices are covered, as with a board or a mulch, the evaporation into the atmosphere is relatively slight. If they are covered with a mulch of ashes or sawdust, a similar result may be attained. A dry earth-mulch may be made on the spot by tilling the upper 2 or 3 inches of soil. The philosophy of summer tillage is to prepare and to maintain this mulch of soil, thereby interposing a relatively non-capillary stratum between the moist soil and the air. This earth-mulch may itself be dust-dry, but it protects the soil beneath. There is more or less evaporation into the interstices of the earth-mulch itself, and some of the moisture ascends through the mulch and escapes into the atmosphere; but it has been found by long experience and by experiments that the earth-mulch greatly lessens evaporation. The frequent stirring of the surface soil in summer is said to make the land moist; as a matter of fact, it keeps it moist. When it is impracticable to keep a surface mulch by means of tillage with horse tools or a rake, it is sometimes advisable to use straw or manure. Mulching newly set trees is often desirable when it is not possible to till the land or not practicable to water them. The ideal mulch to con-

serve moisture, however, is the loose layer of earth, since the stirring of the soil not only provides the mulch but also sets at work various chemical and biological forces that make the plant-food more available.

All herbaceous plants and most shrubs are benefited by a mulch in the fall, no matter how hardy they may be in the given locality. Nature's mulch is the debris of fallen leaves, grass and other litter. The autumn leaves that blow into the borders and the clumps of shrubbery, afford the very best winter mulch; and yet it is a common practice scrupulously to collect and burn these leaves in the fall, and then if the plants are mulched to apply manure. This is doubtful wisdom. The herbaceous border will be benefited by a loose open mulch, 4 to 6 inches deep. If the mulch is of such character as to become very hard and dense, and to hold too much water, it may be injurious. Leaf-mold, loose muck or peat, autumn leaves mixed with some litter that will prevent them from packing too hard, manure which is not too strong in nitrogen and potash, fine straw, sawdust, shavings, pine-needles, evergreen boughs—these are some of the materials that may be used as a mulch to good advantage. If the mulch has thoroughly decayed by spring, it may be left on the land and it will make a fine loamy covering that will be much like the vegetable-mold found in the woods. Too often the passion for cleanliness sacrifices the welfare of the border. Persons will collect and burn every stray autumn leaf, but will not notice many kinds of dirt which are really objectionable. The mulch keeps the surface of the soil loose and mellow because it protects it from the beating of heavy rains and the weight of snow. The vegetable-fiber that works into the surface also prevents the particles of heavy clay soils from running together or puddling. Soils that are covered with a mulch do not bake.

Fall-set herbaceous plants, as pansies, should be covered with 2 or 3 inches of straw or other material to protect them from "heaving" and from the direct injury of alternating conditions.

Whenever the mulch contains soluble plant-food, the soil receives the leachings and is enriched. Stable-manure is an ideal mulch for enriching the soil, but if the manure is fresh and strong, it is likely to injure the crowns of some plants.

L. H. B.

MULGEDIUM (name alludes to the milky juice). *Compositæ*. A group by most authors united with *Lactuca*, but differing in the blue to white rays, and the oblong mostly beaked achene. It is also closely allied to *Senecio*. Some species are offered as outdoor garden herbs; annual, biennial and perennial. Plants of easy culture. The following species might properly be included in the account of *Lactuca*, although the nomenclature of some of the garden forms is open to doubt.

alpinum, Less. (*Lactuca alpina*, Benth. & Hook.). Perennial, 3 ft., erect; lvs. alternate, the radical lyrate-dentate and petioled, the terminal lobe large; fls. deep blue, like those of wild chicory, numerous, in a corymbose cluster; involucre of unequal scales in several series, hairy. Eu., in mountains and far N., prized for its abundant foliage and attractive fls.; requires a moist somewhat shaded place.

thianschânicum, Regel & Schmalh. Glabrous, robust, 3-5 ft. tall; lvs. sharply dentate or the upper ciliate-dentate; the lower lyrate with the terminal lobe very large, lateral lobes confluent with the broadly winged petiole, cordate and clasping at the base; raceme much elongated, simple, or branched at the base only; heads oblong, many-fl.; involucre glabrous; fls. blue, twice as long as the involucre; achenes linear-oblong, multistriate, narrowed toward the apex; pappus hairy, deciduous. Cent. Asia.

macrophyllum, DC. Perennial: st. strict, hispid at top; lvs. ample, sublyrate, cordate at base, hairy

beneath, the terminal lobe large and cordate; panicle lax, hispid, with blue-rayed heads of size of chicory; involucre sparsely hispid.—Said by the older botanists to come from N. Amer., but probably European.

M. Bourgaei, Boiss. = *Lactuca Bourgaei*, described on p. 1766. — *M. giganteum*, Hort. (*Lactuca gigantea*, Hort.) Perennial, 6-8 ft.; fls. blue-violet, paniculate. Probably of garden origin, or a form of some robust species. — *M. Plumieri*, DC. (*Lactuca Plumieri*, Gren. & Godr.). Perennial, glabrous; st. erect; lvs. runcinate-pinnatifid, somewhat glaucous beneath; panicle sub-corymbose, bearing rather large blue-rayed heads. Mountains of Cent. and S. Eu.

L. H. B.

MULLEIN: *Verbascum*. *M. Pink*: *Lychnis Coronaria*.

MURRĀA or **MURRĀYA** (one of the *Rutaceae*, named for J. A. Murray, 1740-1791, professor in Göttingen) is now referred to *Chalcas* (Volume II, page 729). There is only one of the species in general cultivation, the orange jessamine, *Chalcas exotica* (or *M. exotica*), from India, China, Australia and the Pacific islands. P. J. Berckmans writes (A. F. 11:1367, with picture) that it "needs ample pot room and a liberal supply of plant-food. An annual application of bone-meal when repotting in February intensifies the color of the foliage, increases the size of the flowers, and causes it to bloom more frequently. When properly treated, the first crop of flowers usually appears here [Georgia] during May, another during July, and this is succeeded at intervals of from four to six weeks until fall. For winter, give it the temperature of a cool greenhouse, but during summer it thrives best when given full sunshine outdoors." The other species of *Chalcas*, of which there are perhaps a half-dozen in the Indo-Malay region, are probably not in cultivation in this country. *Chalcas paniculata*, Linn. (*M. paniculata*, Jack), is probably a form of *C. exotica*. It is the satinwood or cosmetic bark tree. Arboreal; corymbs few-fl. or fls. solitary.—The wood of this species is considerably used because of its strength and endurance and light yellow color. The bark is used as a cosmetic.

C. Koenigii, Kurz. (*M. Koenigii*, Spreng.). Lvs. 10-20-foliolate, pubescent or rarely glabrous. Along the foot of the Himalayas in India.—A small, strong-smelling tree. The bark, lvs. and roots of this species are used in India as a tonic. Other little-known species occur in India and Indo-China.

WALTER T. SWINGLE.†

MŪSA (named after Antonio Musa, physician to Octavius Augustus, first emperor of Rome, 63-14 B. C.). *Musaceae*. The largest of tree-like herbs, grown for the ornament of their large striking foliage, for fruit, and for fiber.

Bulbous or with perennial rootstocks; lvs. usually gigantic, entire, oblong or elliptic, pinnately parallel-veined, arranged in a loose rosette, sometimes dark above and glaucous beneath, with a narrow red edge, usually bright green on both sides; in the young state with narrow hyaline margins beautifully crimsoned or white; midrib with a deep rounded groove above; sheathing petioles long or short, forming a false st. like structure; fls. unisexual, in half-whorl-like clusters in a terminal spike (Fig. 462, Vol. I), each cluster subtended by a large spathe-like, colored bract, and all borne on a long or short often velvety or puberulent rachis emerging from the center of the leafy envelopes at the top of the false st.; lower clusters female, upper male (actually hermaphrodite female and hermaphrodite male, the opposing parts being dwarfed, functionless or sometimes absent); perianth consisting of a calyx at first tubular but soon splitting down one side with a 3-5-toothed apex and opposite the calyx a single simple or 3-toothed petal; stamens normally 6, 5 with 2-celled versifixed anthers, the sixth usually suppressed; ovary inferior, 3-celled, cells with many superposed ovules; fr. a large berry, short or elongated, pulpy or dry, angular, oblong or cylindrical; seeds when produced are $\frac{1}{8}$ - $\frac{5}{8}$ in. diam., subglobose or angled by pressure, testa hard, indented at the base and apex, albumen

mealy, embryo subtruncate.—Sixty-seven species and over 200 cult. varieties are known, native of Trop. Asia, Afr., Austral. and adjacent islands. The fruit of the banana is of great importance in the tropics for food. It is imported in large quantities into the U. S. from W. Indies and Cent. Amer. and grown in the Gulf States (see *Banana*). Several ornamental species are grown extensively in the N. and are hardy from 38° north to 35° south latitude. Latest publications: Baker, *Species and Principal Varieties of Musa*, K.B. 229-314 (1894). Schumann, *Das Pflanzenreich* 45:13-28 (1900). Fawcett, *The Banana, Its Cultivation, Distribution and Commercial Uses*, 1913. Popenoe, *Origin of the Banana*, *Journal of Heredity* 5:273-280 (1914).

When plants of a most gorgeous tropical effect are wanted, they will always be found among the musas. To grow these plants to perfection, a large greenhouse will be required. The musas can be increased from suckers, which are found around old plants, and which can readily be separated from the parent plant with a piece of root. These suckers may be potted up into 4-, 5- or 6-inch pots, using a compost of fibrous loam three parts, well-decayed cow-manure one part, enough sand to



2403. *Musa Ensete*.

keep it open and porous, and a good dash of bone-meal. Pot each sucker firmly. These young plants should be placed in a very close and humid atmosphere so as to encourage quick growth. They prefer a night temperature of not less than 68° with about 10° to 20° more during the day. These young plants may be started anywhere from the middle of February up to the first of April. When they have filled their pots with roots, they can be shifted into pots two sizes larger. These shifts can be kept up until they are in tubs 2 feet square. As the shifts become larger make the compost richer, as they are rank feeders. When musas are grown for decorative purposes, it will be found convenient to have them in tubs as they are more easily moved. When they are wanted to show the production of fine fruit, they should be planted out in the middle of a roomy house where the night temperature does not fall below 65°. During the spring and summer months, let the temperature increase in proportion to the outside conditions, as musas delight in a high temperature. They will stand much feeding and should be given liquid manure once or twice a week during the spring and summer months. By giving care to watering, syringing and ventilation, they will grow rapidly. While musas like plenty of sunshine, they are some-

times better for a slight shading during the middle of the day, but only enough to prevent scorching of the foliage. During the winter the night temperature may be lowered to 60°. They will also require less water and syringing. The musas used for subtropical beds and gardens are grown from seed, such as *M. Ensète*, *M. Basjoo*, *M. superba*, and the like. These seeds may be planted in pans or flats in a compost of loam, leaf-mold and sand in equal parts. The seeds should be covered about four times their size in depth and pressed firmly. These pans should be placed where they can have plenty of bottom-heat. When the seedlings appear, pot them off and grow on the same as above. These plants can be lifted in the fall and the soil shaken off and placed in some house or cellar where the temperature does not go below 45°. (J. J. M. Farrell.)

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A. *Sts. short, bottle-shaped; male fls. many to a bract, free petal usually 3-toothed; fr. not edible; usually not stoloniferous.* (Subgenus *Physocalis*.)

B. *Free petal entire; seeds few, large (about 1 in. diam.).*

1. *ventricosa*, Welw. (*M. africana*, Bull. young form). Whole plant 8-10 ft. high, not stoloniferous: sts. much swollen, 4 ft. diam. at base: lvs. oblanceolate-oblong, 4-5 ft. long, thick in texture, bright green; midrib pale red; spike drooping; calyx entire; free petal entire, $\frac{1}{3}$ in. long; fr. coriaceous, dry, 2-3 in. long; seeds about 1 in. diam., angled by pressure. Angola, in rocky places near rivulets.—Cult. in S. Calif. Tender but more ornamental than *M. Ensète*.

BB. *Free petal 3-toothed or lobed.*

c. *Seeds few, large (about $\frac{3}{4}$ -1 in. diam.).*

D. *The seeds smooth.*

2. *Ensète*, Gmel. (*M. abyssinica*, Hort. *Ensète edule*, Horan.). ABYSSINIAN BANANA. Fig. 2403. Whole plant 30-40 ft. high, not stoloniferous: st. 13-20 ft. high, swollen at the base: lvs. oblong, acute, often 20 ft. long by 3 ft. wide; midrib red; bracts densely imbricated, 9-12 in. long, dark claret-brown; spike erect; fls. whitish, $1\frac{1}{2}$ -2 in. long, often 20 or more in a cluster; calyx 3-lobed; free petal short, 3-lobed; fr. coriaceous, dry, 2-3 in. long; seeds 1-4, black, glossy, nearly 1 in. diam., with a prominent raised border around the hilum. Mountains of Abyssinia. B.M. 5223, 5224. R.H. 1861, p. 124, note; 1888, p. 32. G.C. H. 15:435; 21:19; III 16:697. Gu. 47, p. 5; 48, p. 406. V. 5:53. F.E. 11:470. G.M. 52:655; 54:375.—The largest known, as well as one of the oldest (being represented in ancient Egyptian sculptures), and most widely cult. of all decorative bananas. Cult. in S. Calif. and Fla. Prop. entirely from seed in hotbeds. Yields a good fiber.

ND. *The seeds longitudinally ribbed.*

3. *Holstii*, K. Schum. Whole plant 15-20 ft. high: lvs. 15-18 ft. long by 3 ft. wide; spike very large, drooping; upper bracts covering the male fls. 8-10 in. long, persistent; male fls. about $\frac{1}{2}$ in. long, stalked; calyx $1\frac{3}{4}$ in. long, more or less deeply lobed, lobes linear,

hooded at apex; free petal $\frac{1}{2}$ - $\frac{3}{4}$ in. long, broadly elliptic, 3-5-lobed, the middle lobe oval and laterally toothed; fr. pyriform, about 4 in. long by 2 in. wide; seeds about $\frac{3}{4}$ in. diam. German E. Afr., in deep wooded ravines at 3,600-3,800 ft. altitude.—Intro. into cult. in 1905. Decorative.

CC. *Seeds many, comparatively small ($\frac{1}{8}$ - $\frac{1}{2}$ in. diam.).*

D. *Foliage glaucous.*

E. *Lvs. mucronate pointed, thick.*

4. *religiôsa*, Dybowski. Whole plant about 8 ft. high, forming a true bulb like *M. Gilletii*, 2-2 $\frac{1}{2}$ in. diam., but differing in having roots from the whole bulb instead of from the top of the bulb only: lvs. glaucous, oblong-lanceolate or elliptic, mucronate pointed, dying down, the bulb going through a resting-period: fls. undescribed; fr. full of seeds, inedible; seeds smooth, black, brown or gray. French Congo. R.H. 1901, pp. 157, 158.—The lvs. are thick and not easily broken by the wind. Considered by some to be more ornamental than *M. Ensète*. Intro. into U. S. about 1908.

EE. *Lvs. not mucronate pointed, thin.*

5. *Martretii*, Cheval. Whole plant 20-25 ft. high: lvs. large, glaucous: fr. cylindrical, short, yellow; seeds smooth, black, $\frac{3}{8}$ - $\frac{1}{2}$ in. diam. Guinea.—The fr. is edible, but the pulp is not abundant and of indifferent quality. A good ornamental for S. Calif. and Fla. Intro. into U. S. in 1908.

DD. *Foliage not glaucous.*

E. *The seeds tuberculate.*

6. *Livingstoniana*, J. Kirk. St. conical, 10-12 ft. high, 2-3 ft. diam. at the base: lvs. crowded, narrow, oblong, as long as st.; petiole broad, clasping, deeply grooved; fr. 4 in. long, many-seeded; seeds $\frac{1}{3}$ in. diam., globose, angled by pressure, dull brown, tuberculate; hilum deeply depressed, surrounded by prominent edges. S. E. Trop. Afr., up to 7,000 ft. altitude.—Decorative. Yields a good fiber. Intro. into U. S. in 1907.

EE. *The seeds smooth.*

F. *Fls. 10-15 in a row.*

7. *superba*, Roxb. Whole plant 10-12 ft. high, not stoloniferous: st. 2-2 $\frac{1}{2}$ ft. diam. at base, narrowing to 1 ft. below lvs.: lvs. 5 ft. long, oblong, narrowed to base; petiole very short, deeply grooved; spike at first globose, 1 ft. diam., one-third the length of st.; bracts orbicular, dull claret-brown, up to 1 ft. long; fls. in dense rows of 10-15 each; calyx 1 in. long, whitish, formed of 3 loosely cohering segms.; free petal short, 3-toothed with a long linear central tooth: fr. oblong, subcoriaceous, 3 in. long, $1\frac{1}{2}$ in. diam.; seeds very numerous, $\frac{1}{3}$ - $\frac{1}{2}$ in. diam., smooth, brown, subglobose, angled by pressure. India. B.M. 3849, 3850. G.C. III. 35:83. R.H. 1877, p. 277; 1888, p. 33. F. 1873, p. 273. Roxburgh, Plants of Coromandel, 3:223. Wight, Icones Plantarum, 2017.—Decorative, and yields a poor fiber.

FF. *Fls. 3-7 in a row.*

G. *Fr. 2 in. long; free petal $\frac{1}{2}$ in. long.*

8. *Gilletii*, De Wild. Whole plant 5-8 ft. high, not stoloniferous: lvs. about 5 ft. long; spike short, drooping; fls. 5-6 in a row; free petal 3-toothed, nearly $\frac{1}{2}$ in. long; fr. about 2 in. long; seeds 9 or 10, about $\frac{1}{3}$ in. long. Congo Free State.—Cult. in Fla.

GG. *Fr. 4 in. long; free petal $\frac{2}{3}$ in. long.*

9. *Arnoldiana*, De Wild. Whole plant 12-15 ft. high, not stoloniferous: lvs. 7 ft. long, 13 ft. diam. at base: spike short, drooping; fls. 3-7 in each row; free petal 3-toothed, about $\frac{2}{3}$ in. long; fr. nearly 4 in. long; seeds 12-16, about $\frac{1}{2}$ in. long, smooth, broadly pyriform. Congo Free State. G.W. 9:401.—Decorative and showy. Cult. in S. Eu.

AA. *Sts. cylindrical; usually stoloniferous; male fls. many to a bract; fr. usually edible.* (Subgenus *Eumusa*).

B. *Fls. rose-red.*

10. *Martini*, Hort. Similar in habit to *M. paradisiaca*: lvs. oblong, long-petioled, firm in texture, bright green above, glaucous beneath with reddish veins; fls. bright rose-red; fr. small, yellowish. Intro. from Orotana Botanical Garden, Teneriffe, in 1893. R.B. 18, p. 107.—A good foliage plant for exposed places.

BB. *Fls. yellowish white.*

C. *Sts. short (1-6 ft.): petioles short.*

11. *Cavendishii*, Lamb. (*M. chinensis*, Sweet. *M. sinensis*, Sagot. *M. humilis*, Perr.). CHINESE DWARF BANANA. DWARF JAMAICA. Whole plant 4-6 ft. high, stoloniferous: st. 2-3 ft. high; lvs. 6-8 in. in a dense rosette, spreading, oblong, 2-3 ft. long, 1 ft. wide, rounded at base, glaucous; petiole short, stout, deeply grooved; blades when young spotted and blotched with red; spike dense, short, drooping; bracts red-brown or dark, lower 6 in. long, upper 3-1 in. long; male fls. and their bracts persistent; calyx yellowish white, 1 in. long with 5 obtuse lobes; free petals about $\frac{1}{2}$ in. long; fr. as many as 200-250 in a bunch, oblong, 6-angled, slightly curved, 4-5 in. long, $1\frac{1}{2}$ in. or more diam., obtuse, gradually narrowed to the sessile base, seedless, edible; skin rather thick; flesh delicately fragrant. S. China. Intro. from Mauritius in 1827. P.M. 3:51. Gn. 32, p. 243; 40, p. 263; 44, p. 496; 50, p. 161. G.C. III. 22:167.—Stands more cold than most bananas, and its dwarf growth readily allows for protection. Good for shipping and may be planted N. Extensively grown along the coast of the southern states and in the W. Indies.

CC. *Sts. tall (over 6 ft.): petioles long.*

D. *Spikes erect or suberect.*

12. *Fèhi*, Vieill. (*M. Fèi*, Nadeaud. *M. Seëmanii*, F. Muell. *M. Uranoscopus*, Seem. *M. troglodytarum*, S. Kurz., not Lour.). STOLONIFEROUS: st. 15-20 ft. high, full of violet juice; lvs. larger and firmer in texture than *M. paradisiaca*, with stouter veins; base unequally rounded; petiole 1- $1\frac{1}{2}$ ft. long; spike long, erect, slightly curved at the base; fls. 6-8 in a cluster, sessile; calyx with 5 unequal lobes, finally splitting nearly to the base; free petal short; fr. many in a bunch, oblong, angled, 5-6 in long, 1 in. or more diam., nearly straight, yellow when ripe, skin thick; pulp moderately firm; seeds small, dull black. Tahiti and New Caledonia. Seedless at low levels but bearing seeds at elevations of 3,000-3,600 ft. G.C. III. 8:182.—Cult. in Eu. Fruits not very palatable when raw but excellent when cooked.

DD. *Spikes drooping.*

E. *Outer calyx-lobes with horn-like hooks.*

13. *téxtilis*, Née (*M. mindanensis*, Rumph. *M. silvestris*, Colla. *M. troglodytarum textoria*, Blanco. *M. Abacá*, Perr.). ABACA. MANILA HEMP. Whole plant 13-22 ft. high, stoloniferous: lvs. oblong, deltoid at base, bright green above, glaucous beneath, often with large brown spots; petiole 1 ft. or more long; spike drooping, shorter than lvs.; male fls. deciduous; calyx 5-lobed, about $1\frac{1}{2}$ in. long, the outer lobes with a curved, threadlike horn near the apex; fr. obscurely 3-angled, curved, 2-3 in. long, 1 in. diam., not edible, filled with seed; seeds black, turbinate, $\frac{1}{6}$ in. diam., angled by pressure. Philippine Isls.—Furnishes one of the most valuable fibers known for the manufacture of rope. Cf. p. 171, Vol. I; also Cyclo. Amer. Agric., Vol. II, p. 256. Much grown in the Philippines.

Var. *amboinensis*, Miq. (*M. amboinensis*, Rumph.). Not so tall and spike not so drooping; fr. about 3 in. long, black at maturity. Amboina.—Cult. in the Philippine Isls. and used in the manufacture of Manila hemp.

EE. *Outer calyx-lobes without horn-like hooks.*

F. *Free petal nearly as long as the calyx.*

14. *Basjoë*, Sieb. & Zucc. (*M. japonica*, Hort.). JAPANESE BANANA. Whole plant 12-18 ft. high, stoloniferous: st. 6-9 ft. high, 6-8 in. diam.: lvs. oblong, thin bright green, 6-9 ft. long, $1\frac{1}{2}$ -2 $\frac{1}{2}$ ft. broad, deltoid at base; petiole stout, about 1 ft. long; spike dense, $1\frac{1}{2}$ ft. long; female clusters 3-4, close, 12-15 fls. each; bracts oblong, dull brown, lower 8-12 in. long; male clusters 8-12, their bracts much imbricated, persistent; calyx whitish, 2 in. long, shortly 5-toothed at apex; fr. 30-60, oblong, pointed, 3-angled, 3 in. long, narrowed to a sessile base; seeds few. Liu Kiu Archipelago. B.M. 7182. R.B. 22, p. 152. R.H. 1896, p. 203. G.M. 54:376.—Cult. in Japan for fiber. Decorative and hardy as *M. Ensete*.

FF. *Free petal half the length of the calyx.*

15. *paradisiaca*, Linn. PLANTAIN. COOKING BANANA. ADAM'S FIG. Whole plant 20-30 ft. high, stoloniferous: st. 20-25 ft. high; lvs. oblong, thin, bright green, 5-8 ft. long, $1\frac{1}{2}$ -2 ft. wide, usually rounded at base; petiole 1- $1\frac{1}{2}$ ft. long; calyx drooping, often 4-5 ft. long; bracts mostly persistent, lanceolate or oblong-lanceolate, dull violet, more or less glaucous outside, the lower 1- $1\frac{1}{2}$ ft. long, the upper $\frac{1}{2}$ ft. long, often red inside, several expanded at once, the edges of the upper not involute; male fls. mostly persistent; fls. about a dozen to a cluster, yellowish white, $1\frac{1}{2}$ in. long; calyx 5-toothed at the top; free petal oval, half as long as the calyx; fr. cylindrical, $\frac{1}{2}$ -1 ft. long, usually yellow or yellowish green when ripe, 40-80 in a bunch, flesh firm, not so sweet as the banana. Native of India. R.H. 1888, p. 69. L.B.C. 7:684. Redouté, Liliaceae, 443, 444.—Universally cult. in the tropics, especially in the W. Indies and Cent. Amer. Not suitable to eat without cooking.

Subsp. (I) *sapiéntum*, Kuntze (*M. sapiéntum*, Linn.). COMMON BANANA. Male fls. deciduous: fr. yellow, somewhat 3-angled, 3-8 in. long, $1\frac{1}{2}$ -2 in. diam. India. Trew, Plantae Selectae, 21-23. Rheed, Hortus Malabaricus 1:12-14.—Most of the commercial bananas are obtained from the numerous varieties of this subspecies.

a. *Fr. with thin skin.* (Subsp. *sapiéntum*.)

Var. (a) *Chámpa*, Baker (*M. Chámpa*, Hort. *M. oriéntum*, Hort.). HART'S CHOICE. LADY FINGER, or GOLDEN EARLY BANANA. CHUMPA. St. and midrib of lf. tinged with red; fr. pale straw-color, about 6 in. long; skin soft and thin; flesh luscious, delicate in flavor, ripening quickly.—Hardy in cool climates. Best of all for growing in Fla. Much grown in the W. Indies.

Var. (b) *rùbra*, Baker (*M. rùbra*, Firming, not Wall.). BARACOA, RED JAMAICA, or RED SPANISH BANANA. St., petiole, fls. and midrib of lf. dull red; fr. at first dark red, ripening to yellowish red. This is the red banana of commerce formerly imported in large quantities from the W. Indies. Fine for decorative purposes but tender. G.C. III. 29:335. R.H. 1905:68.—The golden banana with fr. golden yellow or reddish, 8-9 in. long and blunt, is intermediate between this and var. *Champa*.

Var. (c) *cinèrea*, Blanco. LETONDAL or CHOTDA BANANA. Fr. short, whitish, not angled, thin-skinned; flesh somewhat grayish; delicious; skin splitting and turning back at maturity; perfect seed frequently found.—Intro. from India by a French priest named Letondal. Cult. in the Philippine Islands and Guam.

aa. *Fr. with thick skin.* (Subsp. *sapiéntum*.)

Var. (d) *Dacca*, Baker (*M. Dacca*, Horan. *M. palustris*, Hort.). DACCA BANANA. St. pruinose; lvs. paler green than in the subspecies, glaucous beneath; border of the petiole red; fr. yellow, 4 in. long, 2 in. diam., tip

and base bright green, skin very thick. India.—Flavor good. Tender.

Var. (e) *sanguinea*, Welw. Lvs. and fr. strongly tinged with blood-red.—Intro. into cult. in Eu. in 1903.

Var. (f) *vitata*, Hook. Lvs. and long frs. copiously striped with white and rose; bracts bright red inside. Isl. of St. Thomas, W. Afr. B.M. 5402.—Very decorative.

Var. (g) *ternatensis*, Blanco. CHOTDA DAMA. Whole plant 5–6 ft. high; fls. about 20 to a cluster; calyx often coronate at maturity; free petal pitted at the outer tip; fr. with 3–5 prominent angles; seeds rare. Philippine Isls.—Cult. also in Guam. One of the most palatable varieties.

Var. (h) *magna*, Blanco. CHOTDA TANDAQUE. Fr. 3- to several-angled at maturity, over 1 ft. long by 3 in. diam., more palatable when cooked. Philippine Isls.—Cult. also in Guam. Cloth is made from the fiber but it is not of as good quality as that from abaca.

Var. (i) *suavolens*, Blanco. BUNGULAN. Fr. usually green, with yellowish spots at maturity; angles not conspicuous, obliterated at maturity; flesh fragrant and very palatable. Philippines.—Cult. in Guam.

Var. (j) *Lacatan*, Blanco. LACATAN. Fls. about 14 to a cluster; calyx 5-toothed, the 3 alternate teeth large; fr. angled-obtuse at apex; flesh fragrant, firm. Philippines. Cult. in Guam. Blanco, Flora de Filipinas, 12:88 (1877).—One of the most palatable varieties.

aaa. Fr. unknown. (Subsp. *sapientum*.)

Var. (k) *oleracea*, Baker (*M. oleracea*, Vieill.). A flowerless form with a glaucous, violet st. and elongated, thick, turnip-like rhizome, which is boiled or roasted like a yam, and resembles it in taste. Intro. from New Caledonia, where it does not flower. B.M. 7802.—The tubers have “eyes” like a potato and the plant may be prop. by division. Cult. in Eu. where fls. have been produced but no fr.

Subsp. (II) *troglodytarum*, Baker (*M. troglodytarum*, Linn.). Spike erect in the lower half, drooping in the upper half; fr. small, crowded on the lower erect portion, oblong, cylindric, reddish yellow, containing rudimentary seeds; flesh sweet, yellow. India and Malaya. Blanco, Flora de Filipinas 12:88 (1877).—The favorite food of elephants. Rarely cult. in the U. S.

Subsp. (III) *seminifera*, Baker (*M. seminifera*, Lour.). Frs. small, oblong, full of seed, yellowish or greenish. Not edible. This apparently represents the wild seed-bearing form. Found wild in India, the Malayan and Philippine Isls.

AAA. St. slender, cylindrical: male fls. few to a bract; fr. not generally edible: usually stoloniferous. (Subgenus *Rhodochlamys*.)

B. Lvs. green on both sides.

c. Rachis of the infl. glabrous.

d. Free petal nearly as long as the calyx.

16. *Uranoscopus*, Lour. (*M. coccinea*, Andr.). Stoloniferous: st. 4–5 ft. high, 2–3 in. diam.: lvs. oblong, 2–3 ft. long, 6–9 in. wide; petiole long and slender: spike erect, dense, about 1 ft. long; bracts brilliant scarlet, tipped with yellow, the lower 6 in. long; calyx yellow, 1 in. or more long; free petal nearly as long as the calyx; fr. oblong, 3-angled, not edible; seeds very small, rarely produced in cult. S. China. Botanists Repository 47. Redouté, Liliaceæ, 307, 308. B.M. 1559. L.B.C. 5:475. F.S. 7:722, 723. Martius, Flora Brasil. 3:1.—Intro. into cult. in 1791 and now widely distributed. Very showy. May be grown in 10-in. pots for winter decorations of tropical houses.

DD. Free petal much shorter than the calyx.

17. *Männii*, Wendl. Stoloniferous: sts. slender, cylindrical, tinged with black, 2–3 ft. high, 3½ in.

circum. at base: spike erect, 6 in. long; female fls. in 3 clusters of 3 fls. each, their bracts deciduous; male bracts crowded, pale crimson, 3–4 in. long; calyx pale yellow, 1½ in. long; free petal much shorter: fr. small, 3–4 in. long, fusiform with a broad truncate apex. Assam. B.M. 7311.—Intro. into Eu. in 1893, and into U. S. in 1901.

CC. Rachis of the infl. pubescent.

D. Free petal nearly equaling the calyx.

18. *sanguinea*, Hook. f. Stoloniferous: st. very slender, 4–5 ft. high; lvs. oblong, thin, bright green, 2–3 ft. long, 5–8 in. wide; petiole slender, 1 ft. long; spike at first erect, drooping when mature; female fls. in 2–6 clusters of 2–3 fls. each; male clusters few, dense; bracts lanceolate, somewhat persistent, blood-red, lower 6 in. long; calyx bright yellow, 1–1½ in. long; free petal nearly as long as the calyx; fr. oblong, 3-angled, rather pulpy, pale green variegated with red, glabrous, 2 in. long; seeds angled, small, black, tubercular. Assam. B.M. 5975.—Decorative and showy.

DD. Free petal much shorter than the calyx.

19. *rubra*, Wall. St. slender, 4–6 ft. high; lvs. oblong-lanceolate, 1½–2 ft. long, 6–9 in. wide; petiole long and slender: spike dense, erect; bracts bright red, lower 1 ft. long and sterile, upper 2–4 fld.; calyx yellow; free petal half as long as the calyx; frs. in 3–4 clusters of 3–4 each, cylindrical, dry, 1½–2 in. long; seeds smooth, dull brown, ¼ in. diam. India. B.M. 7451.—Cult. in Eu.

BB. Lvs. glaucous beneath.

20. *sumatrana*, Becc. Whole plant 7–8 ft. high: st. slender: lvs. 5–6 ft. long, 1½ ft. wide, glaucous, with irregular blotches of claret-brown; petiole 1 ft. long; rachis pubescent: spike more or less drooping; lower bracts distant: fr. dry, cylindrical, curved, 2–3 in. long, ½ in. diam. Sumatra, 1,100 ft. altitude. I.H. 27:375. F.S. 10:1061 (as *M. zebрина*, probably a young form of this species, and is very decorative).

BBB. Lvs. red beneath.

21. *rosacea*, Jacq. (*M. ornata*, Roxbg. *M. speciosa*, Ten. *M. Carolinæ*, Sterler.). Whole plant 4–6 ft. high, stoloniferous: st. 3–5 ft. high, 3–4 in. diam.: lvs. linear-oblong, firm, 3 ft. long, 9–12 in. wide, purplish beneath: spike more or less drooping, 1 ft. long; bracts ovate-lanceolate, pale blue or reddish lilac, the lower 6–8 in. long; male fls. deciduous, more numerous than the female; calyx yellow, 1 in. long; fr. oblong, obscurely 4–5-angled, yellowish green, 2–3 in. long; pulp very scant, scarcely edible; seeds ¼ in. diam., black tubercled, rarely produced in cult. plants. India. B.R. 706. L.B.C. 7:615.—Intro. into Calif. in 1898.

M. assamica, Hort. Bull. Trunk about 1½ ft. high; lvs. about 1 ft. long, crowded, running out into a slender tendril-like point, green with a narrow purple border. Assam. This elegant dwarf plant allied to *M. sanguinea* is well suited for table decoration.—*M. imperialis*, Sprenger. A magnificent species with perennial rootstock and enormous somewhat lanceolate lvs. Related to *M. Ensete*. Kamerun. Cult. in Eu. Fls. and fr. not described.—*M. Rhodochlamys*, Hort. A subgenus of *Musa* improperly used in some trade catalogues as a species. See species 16–21.

P. L. RICKER.

MUSÁNGA (W. African name). *Mordecæ*. One W. Trop. African tree allied to *Cecropia*, recommended abroad as shade in cocoa and coffee plantations and also as an ornamental foliage plant: lvs. large, alternate, long-petioled, peltate, divided into 11–15 entire segms.: panicle of small male fls. solitary in axils, of the female twin in the axils. *M. cecropioides*, Br. (*M. Smithii*, R. Br., not Benth.), is described by Hiern as “a very elegant tree, 12–15 ft. high, branched a little above the base, with a broad head and good wood suitable for house-building: lvs. digitate; lfts. 6, 1–1½ ft. long; common petiole more than 7 in. long. (*M. Smithii*, Benth, Niger Fl. = *Macaranga heterophylla*, Muell. Arg., a plant apparently not cult.)

MUSCARI (Latin name referring to the musky odor of *M. moschatum*). *Liliaceae*. GRAPE HYACINTH. Excellent hardy spring-blooming bulbs.

Flowers in racemes or spikes; perianth urn-shaped, slightly or distinctly constricted at mouth; segms. 6-dentate, commonly reflexed; stamens in a double cylindrical tube; ovary 3-celled, sessile, globose-trigonal; caps. sessile, globose; seeds subglobose, black, glistening; bulbs membranous, tunicated.—About 45 species in Sicily, Algeria, European Medit., Spain, Asia Minor, and the Orient. All grape hyacinths are very much alike and are very interesting, botanically, horticulturally and from the artistic point of view. The group needs botanical revision badly. The chief literary sources are Baker in Jour. Linn. Soc., Vol. 11 (1871), and in G.C. II. 9:798 (1878); also Boissier's *Flora Orientalis*. The width of the lvs. is an important character, and Baker's measurements seem to refer to herbarium specimens. Live plants should be wider. (A line is a twelfth of an inch.) They are something like a hyacinth, but the clusters are smaller, and the individual fls. are smaller and of different shape, the grape hyacinths being constricted at the mouth and having 6 small teeth instead of the prominent perianth-segms., as in the true hyacinth.

The common grape hyacinth, which every garden lover knows, is called *M. botryoides*, which means "like a bunch of grapes." Everybody who has any ground for gardening should have some bulbs of this common kind, both blue-flowered and white. All the other kinds described below are fancier's plants, interesting chiefly to skilled amateurs. Among them the most remarkable is the feathered hyacinth (*M. comosum* var. *monstrosum*), which is a mass of lilac shreds (see Fig. 2401). Any species of Muscari is likely to have some sterile flowers at the top of the cluster which are often of a different color, but in the feathered hyacinth there is no suggestion left of the urn-shaped flower, sterile and fertile flowers all being cut into fine strips. This attractive plant has been sold for fancy prices by a few progressive florists.

Grape hyacinths are neat little early flowering bulbous plants, good-sized colonies of which give dainty effects in the border from February to May. There are numerous species of these, flowering at different times. They are mostly dark purple in color, either self-colored or tipped with white. There are also a few white and yellow forms, and several species with true blue flowers,

the rarest color among flowers, though this would never be discovered in catalogues. *M. Szovitsianum*, one of the true blue forms, is quite the prettiest of the genus. The plant known to the trade as *M. lingulatum*, or *Hyacinthus ozureus*, has the true blue of *M. Szovitsianum*, and is fully a month earlier. The usual forms grown in gardens are mostly blue (purple) and white forms of *M. botryoides*. *M. conicum* is very dark. The Dutch catalogues offer numerous kinds to suit amateurs and differing conditions. Muscari offer no difficulties in cultivation. A medium soil perhaps suits them best, but they are usually thrifty growers, and persistent in

the garden if foliage is allowed to ripen. They mostly make offsets freely, and produce abundant seed. (J. N. Gerard.)

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Subgenus I. MOSCHARIA. Perianth urn-shaped, but with a relatively long-tubular base; segms. minute, even for the genus, roundish, spreading and thickened on the back.

1. **moschatum**, Willd. (*M. suavolens*, Fisch.). MUSK OR NUTMEG HYACINTH. Lvs. 5-6, 1 ft. long, $\frac{1}{5}$ - $\frac{3}{4}$ in. wide: raceme loose, 1-3 in. long; fls. 20-50, blue. Asia Minor. B.M. 734. Gn. 26, p. 137.—Has the odor of musk. Seems to enjoy a warm dry border where bulbs mature properly. Sometimes fails to bloom after first year. Vars. *major* and *minor* are advertised. *M. dipadi major* and *minor* have appeared in the catalogues since 1878, but these names have no botanical standing and represent cultural forms, of which there are several.

Var. **flavum**, Lam. (*M. flavum*, Van Tubergen. *M. macrocarpum*, Sweet). Fls. yellowish (Van Tubergen says clear yellow). B.M. 1565.

Subgenus II. LEOPOLDIA. Perianth obovoid-urn-shaped, grooved above, 3-4 lines long; segms. triangular, reflexed, not thickened on the back: raceme loose, and longer than in the next. Particularly characterized by the conspicuous bearded appearance of the sterile fls.

2. **comosum**, Mill. Lvs. 3-4, 1-1 $\frac{1}{2}$ ft. long, $\frac{1}{2}$ -1 in. wide: raceme loose, 6-12 in. long, 40-100-fl'd.; lower fls. fertile, olive, tipped brown, borne on long horizontal pedicels; upper fls. sterile, blue or violet, borne on long upcurved pedicels, making a corymbose cluster. Medit. region, Orient. B.M. 133 (as *Hyacinthus comosus*).—An interesting form, but rare in cult., being greatly surpassed in popularity by var. *monstrosum*.

Var. **monstrôsum**, Hort. FEATHERED HYACINTH. Fig. 2404. All the fls. sterile, and cut up into fine shreds. Gng. 7:290. A.F. 14:1286. Gn. 26, p. 137.—A most interesting plant. Also called fair-haired or tasseled hyacinth, and shredded lilac. Sold also as *M. monstrosum*, *M. plumosum*, *M. plumosum monstrosum*, etc. For other trade synonyms, see under *M. commutatum*.

3. **græcum**, Heldr. Differs from *M. comosum* in having its sterile fls. in a short, dense, conical spike, the pedicels of which are very short. Greece.

Subgenus III. BOTRYANTHUS. Perianth more or less urn-shaped, grooved or not above, 1-2 or rarely 3 lines long; segms. triangular, usually reflexed: raceme dense, 1-2 in. long. Sterile fls. inconspicuously bearded or hardly at all.

A. **Fertile fls. a little longer than broad, obovoid-globose.**
B. Lvs. 3-4; fls. 12-20.

4. **botryoides**, Mill. COMMON GRAPE HYACINTH. Fig. 2405. Lvs. linear-lorate, 3-4 lines wide: scape 6-9 in. long; fls. pale blue, odorless, 12-20. Eu., Orient. B.M. 157 (as *Hyacinthus botryoides*). A.F. 13:1197. Gn. 26:136. R.B. 20:3. Gn.M. 2:117.—The following varieties are offered: *album* (G.M. 51:694. G. 27:235. Gn. 76, p. 106. Gn.W. 22:331. J.H. 111. 58:461), *carneum*, *caruleum*, *leucophæum*, *Lelievreii*,



2404. *Muscari comosum* var. *monstrosum*.

majus, *pallidum* and *pallidum grandiflorum*. These range from white through flesh-color to sky-blue.

bn. Lvs. 5-6; fls. 8-12.

5. *Heldreichii*, Boiss. Lvs. linear-filiform, subterete, $1\frac{1}{2}$ lines wide; scape 4-6 in. long; fls. 8-12, amethyst-colored, with conspicuous white teeth. Greece. Gn. 26:136.

bnb. Lvs. 2-3; fls. 6-10.

6. *lingulatum*, Baker (*M. Aùcheri* var. *lingulatum*, Boiss.). Lvs. 3 lines wide; raceme ovate. G. 34:243 (as *M. azureum*). Asia Minor.—This is apparently a good species, but it is said that the plant sold under this name is the same as *Hyacinthus azureus* (Vol. III, p. 1616). Var. *præcox* is evidently a small form. Cilicia. Gn. 63, p. 75.

AA. Fertile fls. $1\frac{1}{2}$ times as long as broad, obovoid-oblong.

B. Color of fls. black-blue.

7. *paradoxum*, C. Koch. Lvs. 3, $\frac{1}{2}$ - $\frac{3}{4}$ in. wide; fls. rather longer than broad, deep black-blue. Armenia. B.M. 7873.

BB. Color lively dark lilac or blue.

C. Lvs. $\frac{1}{2}$ in. broad.

8. *cœnicum*, Baker. Lvs. about 6, narrower; fls. violet-blue. Habitat unknown. Gn. 51:136; 69:282.—Van Tubergen says fls. black-blue. Var. *album*, white. Gn. 71, p. 252.

9. *armeniacum*, Leichtl. Lvs. several, linear, much overtopping the raceme, reaching a foot at flowering; scape 4-6 in. long, tinted brown at base; raceme dense, 2 or more in. long; axis bright violet; perianth bright deep violet; teeth erect whitish; sterile fls. pale blue. Armenia.—One of the most handsome species, flowering the latest.

cc. Lvs. $\frac{1}{2}$ to $\frac{1}{6}$ in. broad.

10. *micranthum*, Baker. Lvs. several, overtopping the raceme; scape slender, 5 in. long; fls. bright violet, fragrant; sterile fls. few, sessile, pale blue. Habitat unknown.

11. *Szovitsianum*, Baker. Lvs. several, 5-6 in. long; scape 4-5 in. long; fls. bright blue, considerably larger ($\frac{1}{6}$ in. across, but only $\frac{1}{2}$ in. across in *M. micranthum*), faintly odorous; very large bulb, bearing several racemes of bloom. Persia, Caucasus. B.M. 6855.

bbb. Color nearly white.

12. *pallens*, Fisch. Lvs. numerous, filiform; scape 3-5 in. long; raceme 12-20-fl.; fls. white or nearly so. Caucasus, Iberia.

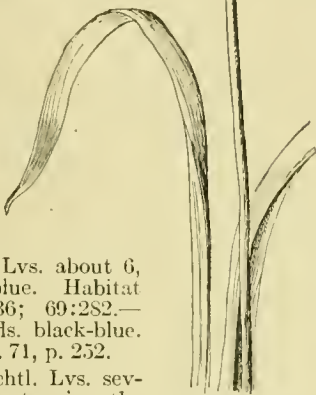
AAA. Fertile fls. twice as long as broad, obovoid-cylindrical.

B. Lvs. almost cylindrical (subterete).

13. *racemosum*, Mill. Lvs. 5-6, 5-6 in. long, $\frac{1}{2}$ in. thick, almost cylindrical; fls. odorous, dark blue. Medit. Caucasus. B.M. 122 (as *Hyacinthus racemosus*). Vars. *cœruncum* and *grandiflorum præcox* are offered.

nb. Lvs. oblanceolate.

14. *latifolium*, J. Kirk. Lvs. always solitary, $\frac{3}{4}$ -1 in. wide, oblanceolate; sterile fls. 6-10, much paler than the others. Phrygia. B.M. 7843.



2405. *Muscari botryoides*. (×12)

bbb. Lvs. *lorate*, i.e., strap-shaped.

15. *neglectum*, Guss. Lvs. numerous, 9-12 in. long, *lorate*, $1\frac{1}{2}$ -2 lines thick; fls. odorous, dark blue. Medit. region. Gn. 26:136. J.H. III. 61:249.—This differs from *M. commutatum* and *M. polyanthum* in having the segms. of the perianth triangular and reflexed. *M. neglectum multiflorum* and *M. neglectum atlanticum* are trade names. See supplementary list under *M. Argai*.

16. *commutatum*, Guss. Lvs. 5-6, 5-6 in. long, $1\frac{1}{2}$ -2 lines wide; fls. odorless, dark blue; segms. very short, not recurved. Sicily.—Krelage advertises vars. *atrocarideum comosum*, *plumosum*, *plumosum monstrosum*, and *plumosum violaceum*. It is apparent that he regards *M. comosum* and its forms as varieties of *M. commutatum*.

17. *polyanthum*, Boiss. Lvs. 2-3 lines wide. Differs from *M. neglectum* and *M. commutatum* in having longer pedicels and the caps. a half smaller, not more than 2 lines wide.

18. *compactum*, Baker. Described only as *Botryanthus compactus* in an obscure work, which states that the fls. are nearly black, with whitish teeth which are semi-orbicular, obtuse, spreading-recurved. Baker places *M. compactum* next to *M. commutatum*, in spite of the fact that the original description says the fls. are obovate. Baker adds that this *M. compactum* is the *M. neglectum* of some authors in part. The plant in the trade as *M. compactum* may be a variety of some common species, since Van Tubergen says the fls. are pale blue.

M. Argai, little known botanically, is said to be extra good. In the trade, *M. atlanticum* is given as a synonym. Baker said he could not distinguish *M. atlanticum* from *M. neglectum*.—*M. atlanticum*. Consult the preceding entry, *M. Argai*.—*M. azureum*, Hort., is said by Van Tubergen to be the same as *Hyacinthus azureus*, which in turn is referred to *H. ciliatus* by Index Kewensis. Gn. 36:126. Van Tubergen also advertises var. *amphibolis* (*M. Freynianum*).—*M. Motlagi*, is offered by Van Tubergen.

WILHELM MILLER.
A. C. HOTTES.†

MUSÈNIUM: *Musneon*.

MUSHROOM. The best usage sanctions the use of the word "mushroom" as a comprehensive term applicable to any and all of the higher fleshy fungi, whether good, bad, or indifferent with respect to edible qualities. With this usage it is then proper to speak of edible, inedible, and poisonous mushrooms of all types. From some quarters there is an inclination to regard only the agarics, or more especially the centrally stalked gill-bearing Agaricaceæ, under this name; thus we would have the field agaric, or field mushroom, the fly agaric, or fly mushroom, and so on. In a commercial sense, *Agaricus campestris* and the allies of this species are everywhere in America the dominant, and usually the only species of interest; so that among certain classes of persons it is not strange to find a tendency toward the restriction of the word to the commoner cultivated forms. The same persons with wider experience would doubtless abandon this usage, and employ the above-mentioned broader application now more generally used, which is also the one of the "mushroom" books.

Another use of the term is as a counterpart of toadstool,—“mushroom” denoting any edible species, and “toadstool” all the inedible or at least poisonous ones. With this criterion we would collect and throw into the “mushroom” basket all species as fast as they might in some way or other receive approval, and we would cast into the toadstool limbo all uncertain or untried and dangerous forms. On the basis of such distinctions, applied to European conditions, there might be on the markets of Munich, Germany, about fifty species for sale as “mushrooms,” since this number is approved by the authorities; but in Berlin, at the dictation of stricter tastes, or rules, the number of recognized “mushrooms” would be scarcely half that

of Munich. "Toadstool" is a term which might well be held sacred to the fairy tales of mushroom life.

It seems probable that mushroom is derived from the old French *mousseron* or *moucheron*, now *mousseron*. An obsolete English form is *musheron*, while *mush-rump* and *mush-rome* have also been used. Among consumers of French canned "champignons" (fungi) there seems to be the feeling that this general term is used only for the cultivated forms, but this is merely a special trade use, and even in popular mushroom books the cultivated forms are carefully distinguished as "champignon de couche."



2406. *Agaricus campestris* (the true mushroom). ($\times 1/2$)

The only mushrooms cultivated extensively in Europe or America are the "common mushrooms," or field mushrooms, consisting probably of several closely related species, which are usually designated *Agaricus campestris*. In reality, there is a group of species, including at least *A. arvensis*, *A. campestris* and its near relatives, *A. villaticus*, probably *A. Rodmani* and *A. fabaceus*, any of which may be cultivated. It is not too much to hope that in time representatives of several other genera of the fleshy fungi may be cultivated for special purposes, but it is doubtful whether any species in culture would yield more abundantly than do the forms now grown. These species closely resemble one another in general characteristics and in life history, so that a description of a common type of *A. campestris* will define all with sufficient accuracy for the present purpose, and it will indicate in general the terminology of all the Basidiomycetes, that is, the class of fungi which contains the larger part of the fleshy forms.

Characteristics of *Agaricus campestris* (Fig. 2406).

The full-grown expanded plant is somewhat umbrella-like, with a central stalk (stipe) supporting a rather thick cap (pileus). The stem may be from 2 to 5 inches in height, about 1 inch in diameter, and above the middle there is typically a ring or annulus, but there are no other appendages about the stem. The cap bears on the under surface the gills, blade-like lamellæ reaching for the most part from near the stem to the periphery of the cap. When the cap of the young mushroom begins rapidly to expand, it breaks away from its attachment to the stem, and the veil of tissue which has hidden the gills from view is ruptured at the periphery of the cap, leaving the ring or annulus already mentioned. When the gills are first disclosed they are of a beautiful pink color, but with age they darken and ultimately become brown-black.

The coloration of the gills referred to is due chiefly to the formation of spores or propagative cells, in large number. If one places the cap of a maturing mushroom on a piece of white paper, gills downward, protecting the cap from rapid drying out, a perfect spore print of the brown-black spores may be made. The number of these produced by a single mushroom expressed in figures is too great to be adequately grasped. The spores are small ovoidal cells, as shown in Fig. 2407, and they are borne upon club-shaped structures termed basidia,—these being organs which are characteristic of the whole class of the Basidiomycetes. The entire surface of the parallel gills is studded with

the basidia, each basidium bearing from two to four spores.

Vegetative and fruiting stages.

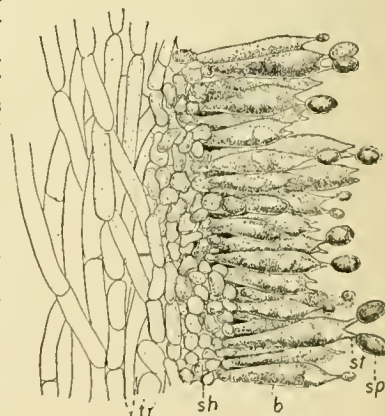
In the open the spores doubtless germinate, but the conditions for their germination are not so well understood that they can be readily duplicated in the laboratory. At any rate, germination of the spores yields a mycelium or thread-like growth that is characteristic of most fungi. The development and growth of the mycelium in rich earth, compost, or manure yields a characteristic "spawn," for "spawn" is merely the abundant development of the mycelium, or vegetative stage of the fungus, in any suitable substratum. In this connection it is well to note that the mycelium of other fungi may invade a great variety of substrata. Rich earth, the moist leaves of the forest floor, fallen timber, and even the trunks of living trees are all invaded by a variety of species, each having its particular growth-requirements. Fresh spawn of *Agaricus campestris* has a fine aroma of mushrooms combined with that of almonds. By this aroma alone it may be easily recognized, and therefore distinguished from the mycelium of common mould fungi. By pure-culture methods, mushroom spawn may also be developed from fragments of the tissue, as subsequently indicated. Spawn is appropriately called the vegetative stage of the fungus.

The mycelium not only absorbs from the substratum the necessary water, together with the organic and inorganic food materials necessary for its immediate growth, but obviously there is accumulated a considerable amount above the growth needs, which serves as a fine adjustment to the heavy demands for food made somewhat later when fruiting begins. With a vigorous development of spawn in earth or compost, fruiting, or mushroom formation, will proceed. At this time the threads of spawn become more strongly corded and matted, attended by the formation of spherical "pinheads," and the latter develop directly into the well-known "button" stages, the appearance and rapid development of which give such satisfaction to the novice in mushroom-growing. With the increase in size of the button and the differentiation of gills, there is next a rapid expansion of the cap and the elongation of the stem, followed by the rupture of the veil. The mushroom is then full grown, at which time the shedding of spores begins.

Mushroom-culture.

In times past, it has been the custom to regard mushroom-growing as more or less of a mystery. It was

therefore considered impossible to lay down specific rules for the guidance of others. This was due primarily to the fact that there had been very little experimental work from which to deduce the principles on which successful culture depends. There is now no reason why an intelligent person should not be able to produce mushrooms successfully if he



2407. Section of a gill of *Agaricus campestris*, enlarged: tr, trama; sh, hymenium; b, basidium; st, sterigma; sp, spore.

is able to give to his work the care and attention which would be bestowed upon the cultivation of delicate flowers or the rearing of poultry.

Within the past dozen years, sufficient has been done to demonstrate the fact that the general principles of production are comparatively simple. The limits of conditions permitting production are narrower than those usually applying to other horticultural crops, yet it is true that the principles in the one case are just as definite as in the other. To state this in terms of its causation, it may be said that many of the more important biological problems concerned in the growth of mushrooms are sufficiently understood to enable us to comprehend the meaning and relative values of the practices which have grown up about this industry, and in many instances to modify these practices advantageously. As a matter of fact, since mushrooms should be grown only in situations which permit the practical control of conditions—that is, of the substratum or compost, the amount of moisture, the temperature, and other factors of the environment,—it should now be, and in the hands of many growers is, a more certain crop than many others commonly regarded as table necessities.

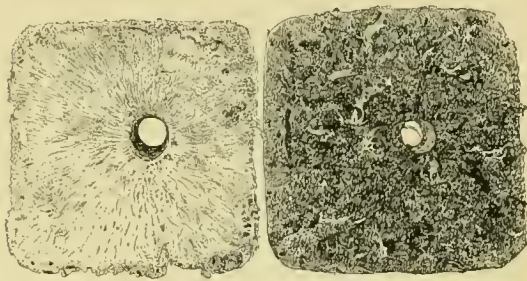
It is no uncommon thing to hear the question asked, "Why is it not possible to produce mushrooms successfully in fields and lawns?" This question might be answered by anyone who reflects for a moment on the commercial success or failure of the pasture and lawn occurrence of mushrooms. One could predict that dandelions would be a successful lawn crop because whether one wills or no they are produced on our lawns in quantity, and sometimes they threaten to take possession where they may not be wanted. Mushrooms also occur in the lawn and field, but how sporadic and unreliable is the supply! One expects to find them in the early fall, but if they are not found, or occur in very limited quantity, it is easy to explain their absence on the ground of insufficient rain, unexpected cold weather, early summer drought, or other obvious causes. This merely indicates that mushrooms are not in any way commercially successful in such situations.

Mushrooms are indeed very sensitive to conditions, and commercial out-of-door culture is possible only in a region where the temperature conditions are fairly uniform throughout a considerable period of time. Moisture is not quite so important, because even in the open this often may be adequately controlled. Out-of-door culture is practised to a limited extent in England and in France, but in no section of the world

beginner. One who has mastered the principles may vary these advantageously for all changes of conditions. The more important factors involved in mushroom-growing, and about which recommendations must center, may be enumerated as follows: compost, spawn, temperature, moisture, and sanitation.

Compost.

Stable-manure furnishes the only satisfactory compost known for commercial mushroom-growing. By a suitable period of fermentation, or composting, the



2409. Spawn of *Agaricus campestris*, pure culture.

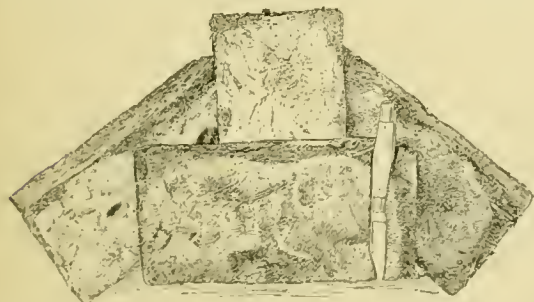
manure becomes more suitable for the growth of the mushroom spawn and less likely to support the succession of mould fungi which would otherwise first run its course. The manure should contain ample bedding material. Straw, shavings, and sawdust are used for this purpose; but straw is preferable from the mushroom-growing viewpoint, as it not only reaches in a short period of time a certain desirable stage of decomposition, but good straw makes likewise a substratum of excellent texture and water-holding capacity.

When the amount of fresh stable-manure is sufficient, it should be wet and somewhat packed. In a few days the temperature will rise to perhaps 120° to 140° F., which is indicative of an active fermentation. The compost is then forked over, or "turned," care being taken to mix the outer with the inner material, and water is sprinkled upon it whenever needed to maintain the compost in a condition which is moist throughout. With straw manure, it is often sufficient to "turn" three times, but a somewhat longer fermentation is not harmful. The turnings may be after intervals of three to five days, the total time required for fermentation in summer being from eighteen to twenty days. When shavings and sawdust occur in some quantity, a longer interval will be required. As soon as the fermentation is complete the beds may be prepared, as described on page 2085.

Spawn (Figs. 2408, 2409).

Prior to 1903 no mushroom spawn had been made in the United States, the larger part of the spawn used being brick spawn imported from England. French flake spawn was also used to some extent. Pure cultures derived by the tissue culture method were first employed by the writer as a source of material for the inoculation of bricks in 1903. Since that time the brick spawn-making industry has become successfully established in this country. In fact, the enormous development of mushroom-growing within the past ten years has been due more to reliable spawn and to the dissemination of information explaining the growth-requirements of these plants than to all other causes combined.

The percentage of failures by amateur growers has steadily declined. It is not to be understood, however, that all failures are due to poor spawn. Still, when one hears the complaint that "the cellar was constantly at a temperature between 50° and 60° F., and not a mushroom appeared," one can be fairly certain that the



2408. Common commercial spawn of *Agaricus campestris*.

is the common cultivated mushroom grown in the open successfully to compete with the product produced in mushroom-houses, cellars, or caves. Owing to the overwhelming importance of the indoor culture, therefore, it is only necessary to describe this as of commercial importance.

It was stated above that rules may be laid down for the cultivation of this crop. Rules must be in a measure arbitrary if they are to be successfully applied by the

spawn was dead. Other causes may determine a poor crop, but seldom no crop. In spite of the fact that reliable spawn is now made, some small dealers will, of course, continue to offer for sale old spawn which has lost all vitality just as they may offer old seeds. It is necessary to be even more careful in the purchase of



2410. Mushrooms growing in a cellar.

spawn than of field or garden seeds. Experiments have shown that spawn stored under the conditions which usually prevail in the cellars or basements of seed-stores is seldom alive for more than one year after it is made.

Temperature.

The most favorable temperature for mushroom-production is about 54° F. Perhaps there is no appreciable difference between 52° and 56° F. More important as principles are the limits of temperature, and the effects of more or less heat than that mentioned. No one should attempt to grow mushrooms in any house or cellar where the temperature is constantly above 60° F. In the warmer atmosphere, all kinds of insects and other mushroom enemies will be active; in fact, insects that are practically torpid at 50° may be extremely harmful and multiply rapidly at 60° F. Apparently at 60° F. the spawn in the beds will be affected more or less by the growth of other organisms, the requisite humidity is not so readily maintained, and "fogging off" is frequent. Moreover, even if the higher temperature lasts only a few days at a time, the quality of the product will be affected. In hot weather the mushrooms are smaller, long-stemmed, and quickly expanded. At a temperature continuously 45° F., mushrooms will develop so slowly as to be unprofitable. A few days of low temperature is not in any sense injurious, for it merely causes delay in production. If one wishes to obtain particularly heavy mushrooms, this can be best accomplished by keeping the temperature fairly low, and occasionally permitting it to fall below 50° F. for a few successive days. Even light freezing does not kill the mycelium in the beds.

Moisture.

It has been noted that after the first watering when the stable-manure is being prepared for compost, the rule is "moist but not soaking wet." No better rule can be given. It is scientifically more accurate to say that the compost in the beds should contain about 60 to 65 per cent of its oven-dry weight of water, but the best practical test of 60 to 65 per cent is that when compressed firmly in the hand it will moisten the hand but drops of water will not be squeezed out with ordinary exertion. When the beds are cased, the surface soil must also be kept moist. Even if the compost below is moist, no satisfactory mushrooms will be produced in a dry soil. On the other hand, to keep the soil wet it is not necessary to drench the bed. The latter serves to make the compost too wet, and the soil may soon be dry again. In the ideal mushroom house, watering

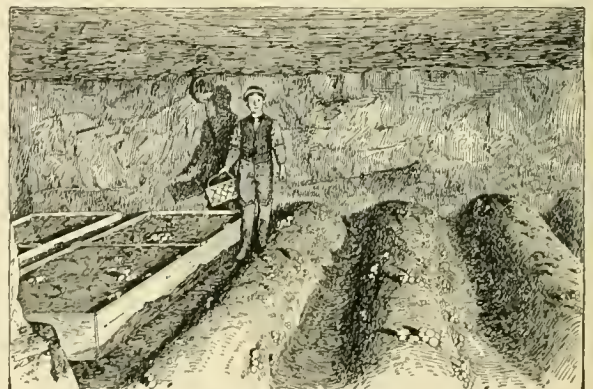
should be required to the extent of no more than one light sprinkling each day; but in small cellars or houses where the heating is by means of stoves, or other similar dry heat method, more frequent sprinkling will be required. The humidity of the atmosphere should be from 60 to 75 per cent. There should be a gradual but slow evaporation. Walls and ceiling may be conveniently sprayed, when necessary, with a Vermorel spray nozzle.

Sanitation.

Sanitation involves (1) good drainage and ventilation, (2) removal of all waste mushrooms, also the clotted and spent mycelium at the bases of mushroom clusters, and especially fogged specimens, and (3) the trapping of insects, whenever they become evident, as well as the regulation of conditions, if possible, so as to prevent their activity. Drainage is a minor matter if the application of too much water is assiduously avoided. Ventilation is particularly necessary in caves and low cellars. Waste mushroom material, whether on the bed or about the cellar, is a constant menace. When mushrooms are picked in clusters, the little buttons in the vicinity which are injured should be removed. All old bases of clusters should be lifted and a handful of fresh earth applied.

Where mushrooms may be grown (Figs. 2410, 2411).

Since the control of conditions is the essential point in the culture of these fungi, it is obvious that mushrooms may be grown in any house, cellar, or cave which will permit the regulation of moisture and temperature, and incidentally of ventilation. It is not the purpose of this article to attempt the discussion of the various types of construction which may be employed in the erection of suitable houses for mushroom work. Any kind of building material may be used, but since a considerable amount of water is necessarily employed, it is well to provide against "sweating," and the drip which accompanies this. As a rule, an air-space in walls is an effective preventive of this condition. The ceiling of the mushroom house may be high or low, depending upon the number of tiers of beds to be used. When it is desired to place the beds on the floor only, the ceiling should be as low as will permit men to work comfortably; for the additional air-space above the bed will be disadvantageous with regard to the control of both heat and moisture. Persons who are making a first trial with mushroom-growing, or those who intend to use a small amount of space for the production of a small quantity intended merely for home consumption, will preferably choose for the purpose any cellar, shed, or other space which may be available. Such space may be adapted more or less



2411. Mushroom-growing in a portland cement cave.

to the special use to which it is put by temporary partitions, false floors, or by other means which will suggest themselves. In those cases in which cellars or caves are used, it is important that there shall be good ventilation. So-called "stagnant" air is almost as bad in mushroom-growing as in greenhouse work. In such air, moreover, the mushrooms will tend to become long-stemmed and the caps will be relatively small. The amount of ventilation will depend upon circumstances, but in all cases it should be sufficient so that there will be a constant, but slight drying of the beds from day to day, requiring occasional sprinkling. There are probably only a dozen places in the United States where mushrooms may be grown advantageously in mushroom beds in the open, and this is primarily due to the variability of the temperature, but partially also, to the difficulty of maintaining the requisite humidity.

Preparation and care of beds.

When the stable-manure has been composted for a period of eighteen to twenty days, it will have lost practically all objectionable odor, the temperature will probably have fallen to 120° to 130° C. (245° to 266° F.), and the texture will be adhesive or oleaginous. In this condition, it may be made into beds. The type of bed commonly employed in the United States and England is a flat bed from 6 to 8 inches deep, and from 2½ to 4 feet wide, depending upon whether it is accessible from one or from both sides. In France the ridge bed is more commonly employed. Somewhat more labor is required in the construction of the latter, but the surface area is considerably increased. The ridge-bed system is seldom employed when the beds are arranged in tiers. It is far more applicable to the growing of mushrooms in caves or cellars. The use of flat beds in tiers, or in the nature of shelves, will often permit one to multiply to the extent of four- or five-fold the amount of available space.

The compost is thrown into the space to be occupied by the bed, arranged as required, and immediately "firmed." The beds should not be hammered down with a wooden mallet as is the custom with some growers. Usually the temperature of the bed rises after the first day, and the maximum is promptly attained. Within a few days the temperature will begin to fall and the bed may be spawned at 70° to 75° F., with the temperature on the decline. In no case should the amateur grower attempt to spawn his beds when the temperature is above 75° F. It does no harm at all to spawn at 60° to 70° F., but a growth begins somewhat more rapidly at the temperature first mentioned. Within a week or so, the temperature should fall to that which has been mentioned as normal for mushroom-growing, that is, about 54° F.

When brick spawn is used, each brick may be broken into about twelve pieces, and one piece will be required for each square foot of bed space. Insert each piece from 1 to 2 inches below the surface, holding it with one hand while pressing the compost firmly about it with the other hand. In the course of about ten days the new growth should become evident about each piece of spawn, and when an examination of the bed discloses this fact, the bed may be smoothed and again firmed, or slightly compressed, such that a person might stand on it without sinking in the substratum more than from 1 to 2 inches. If there has been any drying of the surface layers, the beds should be sprinkled, and it is then ready for the "casing" of loamy soil. A good casing soil is an ordinary light loam, but almost any good garden soil is serviceable for this purpose. The presence of a considerable amount of woods mold in the soil is to be avoided. The soil is applied evenly to a depth of 1 to 1½ inches, and it should be firmed as applied.

Subsequent to the casing, the beds will require no attention except with respect to the regulation of

temperature and moisture. The soil should be kept constantly quite moist, but water should never be applied copiously while the spawn is spreading. Employing good spawn, mushrooms should begin to appear in six to seven weeks, although a longer period of time may be required if sawdust or shaving compost has been used. Under uniform conditions, mushrooms will appear quite regularly all over the bed, and they will, especially at first, have a tendency to come in flushes. When the first flush has been picked, there may be an interval for that bed of several days, or a week, before a second flush will appear.

In harvesting mushrooms, it is usually best to take them before or just at the time that the veil begins to break. At about this time they will have attained their maximum weight, and they make a far better appearance than later. The common method of harvesting requires the operator to take hold of the cap firmly, twisting it slightly, as a result of which the mushroom is often removed from the bed without cutting. When, however, the mushrooms grow in clusters, the assistance of a knife is needed; and it is often possible to remove those sufficiently developed without endangering the growth of smaller ones in the cluster. In preparing the product for the market, the basal portion of the stem is cut off, and the plant is brushed with a medium-sized paint-brush so that it is made free from soil-particles. The best markets require that the product shall be graded into large, medium, small, and old mushrooms. Small growers, however, can seldom afford to adopt this system, and they should cut with such regularity as will insure a fairly uniform size.

Mushrooms, families of.

The cultivated mushroom is one type of the Agaricaceae, a family in which the spore-bearing, or fruiting surface (hymenium) is in the form of leaf-like plates, or gills. The spore prints of the fifty or more genera of this family vary in color from near black through all shades of brown and ochre to pure white.

Agaricus campestris, the common cultivated mushroom or field mushroom, has already been described. It is important to note for this, as for all species of the genus, the brown-black spores, the central stalk, the characteristic ring or annulus, and the gills changing from pink or light brown to brown-black free from the stem. In general, *A. campestris* possesses a simple ring, the stem is fairly uniform in diameter, and the cap varies from a cream-color to various shades of brown or gray-brown. The upper surface is usually smooth, but with alternate wet and dry weather or, as a result of the growth in rooms with variable artificial heat, it may be broken into more or less diamond-shaped areas exposing the white flesh. There are probably several cultivated varieties of this species, but it is often difficult to determine whether a given variety in culture belongs to this or to some related species. Three trade forms—based largely on color—are generally recognized, but within these color limits there are undoubtedly many varieties. The three trade names referred to are: "Alaska," relatively small, white or very light gray forms; "Bohemia," large brown varieties, one of which at least may be *A. campestris*; and "Columbia," which is the name for the large cream-colored forms which may apparently be referred to one of several species.

Agaricus arvensis, ordinarily known as the horse mushroom, has much the same season and habitat as *A. campestris*, and forms occur which seem to be intergrading. Typical forms of the horse mushroom are larger and stouter than the field mushroom and distinguished from the latter by the possession of a double ring. There is some diversity of opinion regarding pileus (color) characters; but in any event there would appear to be several varieties in cultivation which may

be properly referred to this species. Under cultivation the writer has been unable to find any better flavor in *A. campestris* than in *A. arvensis*. *A. Rodmani* and *A. rillatensis* are closely related to *A. arvensis* and *A. campestris*, but there is some doubt as to whether either of these should be regarded as distinct species.

Agaricus fabaceus (*A. subrufescens*) is the almond-flavored and almond-fragrant mushroom, sometimes

found in green-houses or in flower-beds. This species is readily distinguished by (1) the long-persistent membranous veil, the lower surface of which is covered with soft frosty scales; (2) the red-brown to gray-brown (with age) pileus; and the enlarged lower part of the stem. It has been cultivated, but requires a higher temperature than *A. campestris* and is said to be less prolific. It deserves further trial. The spawn grows vigorously in the usual bricks. *A. placomyces* is a woodland



2412. *Lepiota procera*. Parasol fungus. ($\times \frac{1}{2}$)

species, and it is sometimes found from early summer until late fall. The cap is large, flat, and thin, appearing smoky above from the presence of numerous small, dark scales, which are closer together near the center. The veil is like that of *A. arvensis*, and the base of the stem is enlarged. The writer has made spawn of this species, and cultivated it in small quantity.

Agaricus silvicola, also an inhabitant of woods, is almost pure white except as to gills. It is sometimes tinged with yellow, and is always a rather small species, occurring in the summer. Its value in cultivation could be only with relation to its resistance to high temperature.

The question of temperature-resistance is an important one, however, and the discovery of an acceptable edible species which might be grown at from 60° to 70° F. would make it possible to extend the mushroom-growing season to ten or eleven months.

Coprinus.—Aside from *Agaricus*, *Coprinus* is the only other genus of the Agaricaceæ with black spores

which is sufficiently important from an economic standpoint to require consideration. The genus is characterized more particularly by the deliquescence of gills and other parts of the pileus at maturity to an inky black liquid. There are three edible species of common occurrence, appearing usually in lawns in the spring. *C. comatus* (Fig. 2413), the shaggy-mane mushroom, is the largest, and one of the best of the fungi. The whole plant is often 6 inches in height, with a cylindrical cap frequently not less than 3 inches long and 1½ inches in diameter. The name is derived from the



2413. *Coprinus comatus* (Horsetail mushroom).

shaggy scales on the pileus. As the plant approaches maturity the gills are of a salmon-color and there is a free or movable ring. *C. atramentarius*, the true ink-cap, is a shorter form than *C. comatus*, and it commonly occurs in clusters. The shorter, oval cap is slaty gray in color, due to the background of dark gills showing through the hygrophorus tissues. *C. micaceus* is much smaller than either of the preceding, and occurs often in solid phalanx covering several square feet of space about old stumps or over decaying roots. When young, the tan-colored cap is covered with temporary, glistening scales, like minute particles of mica. The only disagreeable feature about the *Coprinus* is their deliquescence, but they are of fine flavor and quality, if eaten fresh.

Lepiota.—The genus *Lepiota* corresponds to *Agaricus* in general characteristics, except that the spores in the former are white. There are many species of this genus, of which the more important are *Lepiota procera* (the parasol mushroom) and *L. naucinoides*. Both are found widely distributed in lawns, fields, or meadows. The parasol mushroom is one of the most conspicuous of the edible agarics, standing frequently 10 inches high with a pileus often 5 to 6 inches in diameter, reddish brown in color, with darker blotch-like scales. The stem is delicate except for the bulbous base. The ring is large and free. *L. naucinoides* in prime condition is usually pure white. It is about the average size of the cultivated mushroom, but with a thinner cap and a stem more slender, thickening toward the base. One who is not an expert should remember that the deadly *amanita* is also white. See *Amanita*, below.



2414. *Amanita phalloides*, poisonous. *V. volva*. ($\times \frac{1}{2}$)

Armillaria mellea, the honey agaric, commonly brownish yellow in general appearance, is typically an autumn plant growing in clusters about stumps and the bases of trees, or appearing through the sod over decaying roots. It is one of the more abundant mushrooms in wooded sections. In form this plant differs from *Lepiota* largely in the fact that the gills are attached to the stem. The spores are white but the gills become discolored with age. This species is parasitic on a number of trees. The mycelium develops a characteristic cord-like, or rhizomorphic stage. This plant is acrid and disagreeable raw, but cooked it is said to be of good flavor.

Amanita.—The genus *Amanita* is interesting for two reasons: (1) because it contains some handsome species, which are quite likely to attract the attention of every beginner in identification; and (2) because among these species there are several which are the most deadly poisonous of all mushrooms. Unless one is an expert,

therefore, it is well to learn the characters of the genus in order to avoid any inclination toward using them for food. The genus contains, it is true, several edible species, and when one knows them there is no danger. *Amanita* possesses all of the general characters of *Lepiota*, likewise certain additional ones which



2415. *Cantharellus cibarius* (chanterelle). Edible. ($\times \frac{1}{2}$)

serve clearly to distinguish it. The white spores (and usually white gills), the annulus, and gills free from the stem are just as in *Lepiota*; but there is in *Amanita* also a volva, or universal veil, which in the mature mushroom appears usually as a cup at the base of the stem, and sometimes remnants of it are carried up by the pileus as frosty scales. In the button stage this universal veil is an outer skin or envelope, and as the plant expands it bursts through the envelope leaving more or less of a cup, or at least a basal ring, at the base; and if the upper part of the envelope adheres to the cup, it is broken into mere scales, or frosty patches, as the pileus grows. Now if one pulls up an *Amanita* carelessly, the volva might not be detected. On the other hand the ring, or veil, might be broken, and then with a volva and no ring the plant might be mistaken for an *Amanitopsis*—a genus with many edible species. Young stages in meadows have been mistaken, indeed, for buttons of *Agaricus campestris*. The *Amanita phalloides*, deadly amanita (Fig. 2414), is widely distributed in the United States, occurring especially in woods and meadows. The plants may attain a height of 6 inches and a pileus diameter of 4 inches. In general appearance it might be mistaken for a *Lepiota*, especially *L. naucinoides*, as some forms of the species may be entirely white. As a rule, however, the upper surface of the cap is grayish, brownish, or greenish. Usually, there are no scales, at any rate no small scales, on the cap, and the volva is cup-like. *A. verna*, the destroying angel, is a pure white plant, regarded by some as one of the white forms of *A. phalloides*. *A. muscaria*, the fly agaric, is only somewhat less poisonous than those above mentioned. It is one of the handsomest mushrooms of the forest. The plant may be larger than *A. phalloides*, and the cap varies from yellow to orange-red in color, with frosty or creamy white scales or patches. In this species the volva is not so prominent, since the universal veil breaks transversely into a number of small incomplete rings, which remain at the base of the somewhat bulbous stem in the form of interrupted rings of scales. The gills and stem are white. *A. Caesarea*, the royal agaric, has also an orange-red cap, but in this species there is a very definite cap-like volva, and the gills of the plant are yellow to orange. This species has been much prized since the earliest historical times, but no one should attempt to use it who is not able clearly to distinguish the different species of *Amanita*.

Tricholoma personatum, the masked tricholoma, is a representative of a genus differing from *Lepiota* in possessing no ring, and further in having the gills attached to the stem, yet notched near the point of attachment. This species is usually pale violaceous or lilac when young, and the pileus is plane or distinctly wavy. The flavor is esteemed. It has been cultivated in experimental beds.

Clitocybe.—In this genus the spores are white and the gills are not only attached but decurrent upon the stem. *Clitocybe velutipes* grows in clusters about stumps and trees, and is readily recognized by the bright red-brown viscid pileus, the pale yellowish gills, and the

dark stems clothed at the base with a growth of hairs velour-like in texture. This fungus is a late fall and winter mushroom, prized by many, in spite of an apparent toughness in the raw state.

Pleurotus.—The members of this genus which are of special interest horticulturally grow on decayed places in the trunks of trees, or on logs, and they are readily distinguished from all other white-spored agarics by the excentric stem. It is typically a clustered mushroom—the clusters being sometimes of enormous size. The plants are white or lightly tinted, and the gills are generally decurrent. *Pleurotus ostreatus*, *P. sapidus*, and *P. ulmarius* are the commoner large species, all of which are edible, but not keenly sought.

Lactarius, the mushrooms which yield a milky juice when the gills are cut or injured, is represented in our woods by several species, of which the commoner edible ones are *Lactarius deliciosus* and *L. volemus*. In form these plants are much like a *Clitocybe*, but the gills are not strictly decurrent. *Lactarius deliciosus* is yellow-buff or light orange, mottled with darker spots or zones, and the juice is orange-colored. The plant is often about 4 inches high and the pileus about 3 inches in diameter. *L. volemus*, a somewhat smaller plant, is of uniform color, brown-orange, or tawny, with white juice. The peppery *lactarius*, a large white species, is very acrid. Closely related to *Lactarius* is the genus *Russula*,—lacking the milky juice,—of which many species with pilei white, greenish, violaceous, or red are found in our woods in summer and early autumn.

Cantharellus cibarius (Fig. 2415), the chanterelle, is one of a group the members of which are barely agarics, for the gills are often almost vein-like, rounded on the margin and often reticulate. The chanterelle is uniformly yellow to orange in color, small, more or less unsymmetrical in form. It is also an inhabitant of the woods, and it is much used as a vegetable food in Europe.

Other Basidiomycetes.

It has been indicated that the larger part of the fleshy fungi are included among the Basidiomycetes, and while the Agaricaceae furnish the greater number of forms of paramount interest to the average layman, nearly all families of these fungi contribute showy or edible species—and some families numerous species. In the Polyporaceae and Boletaceae the spore-bearing surfaces are



2416. *Boletus subtomentosus*.



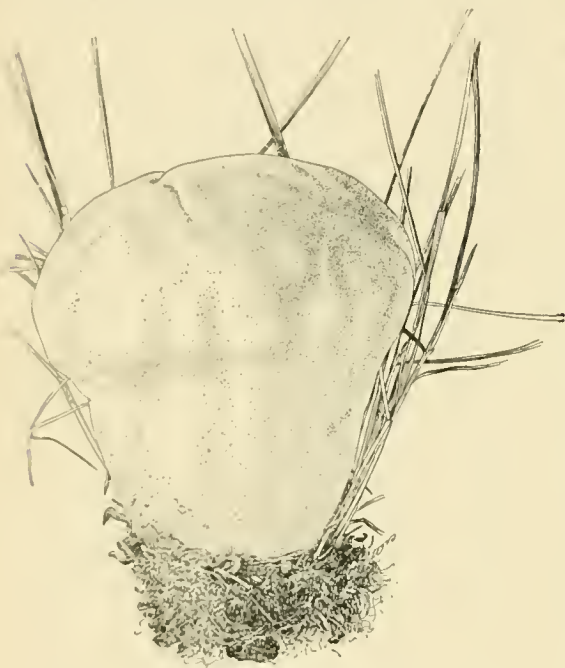
2417. *Clavaria aurea*.—Coral fungus. Edible. ($\times \frac{1}{2}$)

in the form of pores. In the genus *Polyporus* the plants are tougher in texture than those usually edible, and the larger number grow on wood and trees—some causing the more destructive diseases of wood and timber. One of the edible forms frequently observed and most conspicuous is *Polyporus sulphureus*, which forms immense clusters of sulfur-yellow and orange, bracket-like sporophores on a variety of trees and stumps. Many species of *Boletus* are edible, but some are to be avoided, and

some positively toxic. *Boletus edulis* (la cèpe, der Steinpilz) probably furnishes more than any other one species of the fresh wild fungi sold on the markets of European cities. *Boletus subtomentosus* (Fig. 2416) is not poisonous, but is of inferior quality.

Fistulina hepatica, often known as the beefsteak mushroom, is a juicy, fleshy species with red pileus. The plants are bracketed, and grow from the stumps of several hardwoods. The fungus is prized by many, and while widely distributed it occurs sparingly.

The Hydneae are characterized by a spore-bearing surface spread over teeth or spines arising either from a cap-like pileus or from a tubercular or much-branched structure. Among the edible species *Hydnum repandum* possesses a pileus and true stem. It is of a smoky color and occurs in the autumn on the ground in moist woods. *H. coralloides* (coral hydnum) and *H. crinaceus* (satyr's beard) are both delicate white or creamy fungi—both found in the autumn, on logs or trees.



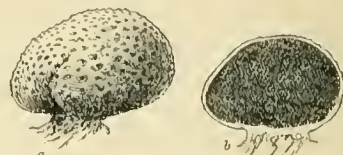
2418. *Lycoperdon craniforme*.

In moist wooded places there appear in the late summer and early fall along with *Boletus*, *Russula*, and other species, several members of the Clavariaceae (stag horn or fairy club fungi). In this family the spores are borne over the whole horn or club-like body. These are of various colors from buff to orange or sooty gray. All species which are of sufficient size to be usable are considered edible. *Clavaria aurca* (Fig. 2417), *C. formosa*, and *C. botrytes* are among the larger forms. In the Thelephoraceae, which include species more or less leathery in texture, the spores are on the lower or outer surface, where that may be distinguished. The horn of plenty, *Craterellus cornucopioides*, a smoky-blue horn-shaped species, is practically the only edible species of interest in this family. The gelatinous fungi, including the Tremellaceae and allied families, are not of sufficient interest to require special description.

Among the Basidiomycetes in which the spores are differentiated internally, or remain long covered, the puff-balls (*Lycoperdaceae*) furnish a number of species of economic importance. All of these plants with white flesh are edible, and some are valuable food accessories. They should be eaten only so long as the flesh is white, and when discolored with age—normally due to the

formation of the spores—they must be discarded. The largest species, *Lycoperdon giganteum* (giant puff-ball), frequently attains a diameter of 16 inches, while specimens over 2 feet in diameter have been reported. This species occurs in gardens and meadows. The flesh

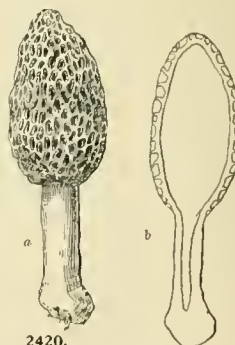
is pure white until practically full size is attained. *Lycoperdon cyathiforme*, the beaker-shaped puff-ball, is common in pastures in the fall. In the young stages the plants vary in color from creamy white to pink-brown, with white flesh. With the formation of spores it becomes purplish throughout, and leaves a purple beaker-shaped sterile basal part. This is perhaps the puff-ball of highest flavor, and consequently the one which should be known by all persons interested in edible mushrooms. *Lycoperdon craniforme* (Fig. 2418) is found in meadows or in open woods. At maturity the plant shrinks, and may become considerably furrowed, from which character the specific name is derived. Resembling smaller members of the Lycoperdaceae externally is a fungus, *Scleroderma vulgare* (Fig. 2419), which is black within, tough and inedible.



2419. *a*, *Scleroderma vulgare*; *b*, section of same. ($\times \frac{1}{2}$)

Ascomycetes.

While the larger part of the flesh fungi belong to the Basidiomycetes, nevertheless the few families of the Ascomycetes furnish some forms of special interest. The family Helvellaceae includes the genus *Morchella* (morels), as well as *Helvella* (saddle fungi) and *Gyromitra* (contorted saddle fungi). There are several species of morels often appropriately called sponge mushrooms, the latter designation being given both on account of the color of the plant and the porous character of the pileus. The morels are widely distributed in the United States. All appear after the warm rains of the spring. They constitute, therefore, about the earliest edible mushrooms. The season is often limited to one or two weeks of favorable weather. *Morchella esculenta* (Fig. 2420) is a common species, and one which appears to be *M. crassipes* is frequently found in the Central States at least. The tuber family (Tuberaceae) includes all truffles, very aromatic subterranean fungi found for the most part in southern Europe, and there constituting a considerable article of commerce. The mycelium of these plants is associated with the roots of certain trees and shrubs, especially oaks. The species most highly prized are *Tuber melanosporum*, the typical French or black truffle, sometimes called the Périgord truffle, which is commercially much more important than all other species combined; *T. aestivum*, which is the summer truffle of France; and *T. magnatum*, a large smooth species with onion-like flavor, which is the commoner form in Italy. The terfas, or false truffles (Terfeziaceae), are also subterranean fungi found associated with the roots of certain species of Cistaceae and Compositae. The regions of their occurrence are primarily semi-arid sections of northern Africa and localities in the Asiatic Mediterranean country. They are apparently the truffles of ancient times. The plants are spherical or ovoidal in form, and at maturity they have a general resemblance in size and texture to a potato.



2420. *Morchella esculenta*. ($\times \frac{1}{3}$)

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B. M. DUGGAR.

MUSINEON (a name for fennel, another plant of this family). Spelled also *Musineum* and *Musénium*. *Umbelliferae*. Four species of resinous perennial herbs in Cent. and W. N. Amer., stemless or branching, decumbent or ascending, 2-12 in. high. Lvs. pinnately decompound; fls. yellow or white, in compound naked umbels; fr. ovate or ovate-oblong, somewhat compressed laterally; ribs 5, filiform, slightly prominent, with 2 or 3 oil-tubes in the intervals.

Hoòkeri, Nutt. (*M. trachyspermum*, Nutt.). Decumbent or ascending, scabrous; lvs., except the radical, opposite, bipinnatifid; fls. yellow; fr. scabrous. Spring. Colo., north.—Procurable from dealers in western native plants.

MUSK. The common musk plant of the gardens is *Mimulus moschatus*, an American plant. The wild musk plant of Europe, however, is *Erodium moschatum*.

MUSK HYACINTH, or **GRAPE HYACINTH**: *Muscari moschatum*.

MUSK MALLOW: *Hibiscus Abelmoschus* and *Malva moschata*. The musk seed of commerce is *Hibiscus Abelmoschus*.

MUSKMELON: *Melon*.

MUSSÉENDA (a native name in Ceylon). *Rubiaceae*. Warmhouse or greenhouse plants grown for the flowers and the colored floral bracts or calyx-leaves.

Erect or climbing shrubs or undershrubs, sometimes herbs; lvs. opposite or in 3's, with stipules between, sessile or petiolate; fls. in terminal cymes, yellow, scarlet or white, the corolla tubular and usually funnel-shaped above and the lobes 5; calyx with an oblong or turbinate tube, one of the 5 lobes usually enlarged (in the cult. species) into a white or colored petioled lf. which may make the plant worth cult.; stamens 5, on the corolla-throat or -tube; ovary 2-celled, the style filiform and the stigmas 2; fr. a fleshy many-seeded berry, with an areole at top.—Species probably 40, in the tropics of Afr., Asia and Polynesia. The few species that are sometimes grown are of easy cult.; prop. in spring by cuttings.

A. *Enlarged calyx-lobes or sepal white*.

frondosa, Linn. Variable species; low erect shrubs, hirsute or glabrate; lvs. either petioled or sessile, oblong to ovate, acuminate; stipules variable, often 2-parted;

fls. yellow, the corolla pubescent or hirsute; calyx with an orbicular or elliptic white leafy lobe; berry obovoid, glabrous, with broad areole. India. B.M. 2099 (as *M. pubescens*).

Sanderiàna, Ridley. Compact in habit, 5-6 ft., sometimes prostrate; lvs. close-set, nearly sessile, lanceolate, cordate, silky hairy; fls. yellow, small and tubular, in numerous terminal cymes; petaloid calyx-lobes white, more than 3 in. long, silky-hairy, very showy. Indo-China. G.C. III. 52:228.

AA. *Enlarged calyx-lobes or sepal red*.

erythrophýlla, Schum. & Thonn. Climber or trailer (or apparently sometimes erect), 30-40 ft., the shoots pubescent; lvs. ovate, acuminate, about 6 in. long, with about 10 lateral veins either side the midrib; fls. to 1½ in. long, in dense pedunculate cymes; calyx-tube very short, the lobes red and hirsute and one of them usually produced into a bright vermilion roundish lf. 2-4 in. long; corolla-tube cylindrical, red-hairy, the rounded apiculate lobes white or yellowish inside; fr. nearly or quite 1 in. long, egg-shaped, red-hairy. Trop. Afr. B.M. 8222. G.C. III. 50:91. Gn.W. 4:553.

M. butkola, Deile. Slender erect twiggy shrub, pubescent; lvs. to 2 in. long, ovate-lanceolate to oblong-lanceolate, acuminate, thin, entire; fls. in 3's in few-fl. cymes, long-tubed, yellow; leafy calyx-lobes white or yellowish, ¾ in. or less long, oblong or ovate-cordate. Trop. Afr. B.M. 5573.—*M. Treutleri*, Stapf. Shrub, somewhat pubescent; lvs. ovate to ovate-elliptic, short-acuminate, to 12 in. long, entire; fls. orange, in many-fl. dense terminal clusters; leafy sepal or calyx-lobes white, shape of the lvs. Trop. Himalaya. B.M. 8254.

L. II. B.

MÚSSCHIA (named after Jean Henri Mussche, of the botanic garden at Ghent). *Campanulaceae*. Two large robust subshrubs or perennial herbs in Madeira, sometimes grown by amateurs; lvs. radical and cauline, the former large and dentate and the latter few and small; fls. rather large, yellow, or fulvous, in pyramidal panicles; calyx-lobes 5, somewhat foliaceous, colored like the corolla or purple; corolla-tube short, cylindrical, with a 5-lobed spreading or recurved limb; stamens 5, free from the corolla; ovary inferior, 5-celled, many-ovuled, the stigma 5-lobed; caps. opening by numerous transverse lateral slits.

M. aurea, Dum. (*Campanula aurea*, Linn. f.). Herb, stemless or developing a st. a few inches high, with thick and fleshy roots, smooth and shining; lvs. in radical tufts, elliptic or elliptic-oblong or lanceolate, serrate; corolla yellow; calyx deeper yellow. B.R. 57.—*M. Wollastonii*, Lowe. Shrubby, pubescent, the st. simple or somewhat branched; lvs. obovate-oblong, thin and flaccid, sharply serrate; fls. dull dark brownish green or purple. B.M. 5606. G.W. 2, pp. 362, 363.

L. H. B.

MUSTARD, species of *Brassica* (which see), chiefly *B. alba*, *B. nigra*, *B. juncea* and *B. japonica*. There are two types of mustard-growing,—for the leaves, which are used as a vegetable; for the seeds, which yield oil and are used as a condiment. Table mustard (the flour) is the product mostly of *B. nigra* (Fig. 636, Vol. I), although seeds of *B. alba* and *B. juncea* are also used for making it. The mustards often become prolific weeds, particularly in grain-fields; they are now controlled by herbicides (see *Weeds*). In California, *B. nigra* covers thousands of acres, thriving best on heavy adobe soils. When the winter rains come, it grows lustily, reaching 16 feet high and more. The bulk of the mustard sold in the United States comes from the county of Santa Barbara, Lompoc being the center of the supply.

As a culinary vegetable, mustard is used for "greens" (which see). For this purpose, the large soft basal leaves are desired. These leaves grow best in early spring, although they do fairly well in autumn. If sown late in the season, the plant makes few bottom leaves and runs quickly to seed. Perhaps the best of the mustards for greens in this country is *B. japonica* (Fig. 634, Vol. I), a species which has long been grown in this country, but which has no other well-known name than "mustard." This often seeds itself and comes up the

following spring. Some of the large-leaved forms of Chinese mustard (*B. juncea*, Fig. 635) are excellent, and should be better known. One of the oriental species (*B. napiformis*) makes an edible turnip-like root (Fig. 632, Vol. I). Mustard needs a rich quick soil for the producing of the best foliage. Sow the seeds in drills 1 foot or more apart, and thin to 6 inches in the row.

L. H. B.

MUTISIA (named after Jos. C. Mutis, 1732-1808 or 1809, botanist of South America). *Compósita*. Showy-flowered shrubs, those in cultivation being tendrill-climbers; greenhouse or planted out.

Erect or scandent, in cult. likely to be herbaceous, glabrous or tomentose; lvs. alternate, simple or pinnate, the midrib usually produced into a tendril; heads large, heterogamous, usually long and the involucre cylindrical or campanulate, solitary on the ends of branches, the few rays purple, rose-colored or yellow; ray-florets in one series, pistillate; disk-florets hermaphrodite, fertile or sterile; receptacle naked, nearly flat: achene angular, turbinate or oblong, crowned with rigid plumose pappus bristles in one series.—Species about 60, in S. Amer., tropical and extra-tropical. The mutisias have never been popular, although long known to cult. They are plants of attractive habit and showy heads. Some of the species need warmhouse treatment, but the following require cooler treatment, and are probably adaptable to growing permanently out-of-doors in the southern limits of the country. Prop. by cuttings.

A. Lvs. pinnate.

Clématis, Linn. f. Climbing herb, rather woody, woolly-pubescent: lvs. pinnate, the rachis extended into a tendril; lfts. 4-5 pairs, short-stalked, oblong-lanceolate, mucronate, entire; heads long-pendulous, oblong-cylindrical, nearly 3 in. long and more than 2 in. across the rays, the latter 9-10, bright red, recurved. Trop. Andes. B.M. 8391. G.C. III. 45:415; 51: suppl. Nov. 29 (colored).—A very vigorous grower, making a good cool greenhouse climber.

AA. Lvs. simple.

ilicifolia, Cav. Climbing slender shrub glabrous or cobwebby: lvs. 1-2 in. long, sessile, cordate or auricled at base, oblong, spiny-toothed and stiff, bright green above, the apex of the blade truncate or 2-lobed, the tendril stout; heads peduncled and solitary in the axils, 3 in. diam., the 8-12 rays pale pink or purplish (pale mauve as described by some). Chile. B.M. 6009. G.C. III. 50:449; 51:383.—The ilex-like foliage is interesting.

decurrens, Cav. Climbing, the sts. somewhat branched, glabrous: lvs. remote, oblong-lanceolate and entire, acuminate, dark green above and glaucous beneath, tendril bifid, the base of the blade decurrent: head solitary, $4\frac{1}{2}$ in. across, the rays brilliant orange. Chile. B.M. 5273. F.S. 23:2408. G.C. III. 50:451, 452. Gn.W. 21:781.—Perhaps the best species. L. H. B.

MYALL: *Acacia*.

MYÓPORUM (Greek words referring to the translucent resinous dots in the leaves). *Myoporaceæ*. Cool-house shrubs, more or less heath-like, grown for the small white or purplish flowers; some are trees.

Erect and tall, or diffuse, glabrous or glutinous: lvs. alternate, rarely opposite, entire or toothed, with pellucid glands: fls. axillary, usually clustered, small or medium-sized, mostly white; calyx 5-ent or 5-parted; corolla somewhat bell-shaped or funnel-shaped, the tube very short or long; lobes usually 5, nearly equal or the anterior perhaps larger; stamens 4, or sometimes 5-6; ovary 2-10-celled: fr. a small more or less succulent drupe.—Species 25-30, Austral., New Zeal., China, Japan, Pacific Isls. The genus is divided by Bentham &

Hooker into 5 sections based on the shape of the fls., the number of the corolla-lobes and stamens, and the number of cells in the ovary. Usually the calyx-segms. are small and narrow, but in one section they are leafy. One of the species (known in cult. as *M. parvifolium*) was once a favorite heath-like plant in France. In 1883 it was stated in the Garden that for 20 years many thousand plants of it had been sold annually in the flower-markets of Paris. One grower always had a stock of 30,000 plants. The plants were grown in small pots for room and window decoration in spring. "It is most beautiful as seen with its pale green branches drooping gracefully around the pot sides, and more especially so when the shoots are wreathed with sweet, snow-white blossoms." Prop. by cuttings taken in spring. This species is practically unknown in Amer. Some of them are said to be useful in Calif. for planting near the seacoast. The American gardener may get some general suggestions from the experience recorded under *Epacris* and *Erica*.

A. Tree of some size.

sandwicense, Gray. BASTARD SANDALWOOD, from the sandalwood odor of the wood. NAIO. "A very handsome tree which reaches a considerable size" (Rock): lvs. crowded toward the ends of the branches, alternate, elliptic-lanceolate or oblong-lanceolate, acute or acuminate, fleshy when growing at the seacoast or low elevations, to 6 in. long, entire or serrate, the young ones viscous: fls. white or deep pink, in clusters of 5-8: drupe dry or somewhat fleshy, globose or ovate, white. Hawaiian Isls.; offered in S. Calif.—"Its thick bark is of a dark gray color and deeply irregularly corrugated." Sold as a substitute for sandalwood.

AA. Shrubs, or the second one sometimes a small tree.

B. Lvs. linear or nearly so.

parvifolium, R. Br. (*M. album*, and *M. rosmarinifolium*, Hort.). Proeminent shrub: sts. 2 ft. long or more: lvs. $\frac{3}{4}$ -1 in. long, linear or linear-spatulate, thick, sparingly dentate toward the apex: fls. with rather acute lobes which are woolly within. Austral. B.M. 1693. L.B.C. 9:837. Gn. 24, p. 361. R.B. 25:253. G.W. 12, p. 150. V. 7:20.—Not advertised in Amer.

BB. Lvs. lanceolate to obovate or elliptic.

lætum, Forst. f. (*M. perforatum*, Hort.). Shrub or small tree: lvs. 2-4 in. long, lanceolate or obovate-lanceolate, acute or acuminate, finely serrate above the middle, bright green, shining, almost fleshy: fls. small, 2-6 in a fascicle, white spotted purple, 4-9 lines wide, with rounded lobes, which are hairy inside. New Zeal.

acuminatum, R. Br. Erect glabrous shrub, very variable: lvs. alternate, from elliptic-oblong to lanceolate or linear, somewhat acuminate, to 3 in. long, entire or very few-toothed: fls. in clusters of 2-4 or somewhat more, or solitary, white, the corolla almost campanulate and about $\frac{1}{2}$ in. long, bearded within, the lobes shorter than the tube: drupe $\frac{1}{4}$ in. or less in diam., almost globular. Austral.; cult. in Calif.

serratum, R. Br. Erect or somewhat diffuse shrub, usually glabrous, exceedingly variable: lvs. elliptic-oblong or lanceolate, obtuse or acute, more or less serrate or entire: fls. usually smaller than in *M. acuminatum*, white and purple, the corolla-lobes usually as long as the tube. Austral.—Offered abroad.

M. pictum and *M. verrucosum* are mentioned in lists, but their botanical standing is uncertain.

WILHELM MILLER.

L. H. B.†

MYOSOTIDIUM (Greek, like a *myosotis* or forget-me-not). *Boraginaceæ*. GIANT FORGET-ME-NOT. A monotypic genus confined to the Chatham Isls., off New Zealand, a promising blue-flowered herb for mild climates.

Myosotidium differs from *Myosotis* in its greater size, mostly large radical lvs., and large winged nutlets. *M. nobile*, Hook. (*Cynoglossum nobile*, Hook. f.), is a stout pilose perennial with long thick cylindrical rootstock, succulent, 1-3 ft. high; radical lvs. broadly ovate-cordate or nearly reniform, petioled, thick and fleshy, 6-12 in. long, but becoming much larger under good conditions in cult.; cauline lvs. few, oblong or broad-ovate, sessile; fls. scentless, dark blue in center and lighter toward the edges (a white-fl. form is reported) in dense corymbose cymes which are 3-6 in. across; calyx deeply 5-parted, the lobes broad-oblong and obtuse; corolla rotate, $\frac{1}{2}$ in. diam., the tube short and the rounded lobes spreading; fr. to $\frac{3}{4}$ in. diam. Sandy soil near the sea "once very abundant on the coast-line of the Chatham Isls.," according to Cheeseman, "but now fast becoming rare in a wild state." B.M. 5137. Gn. 30:566; 50, p. 150; 71, p. 143; 75, p. 580. G.C. II. 25:681; III. 21:293; 44:7; 54:47. G.M. 31:219; 52:87. J.H. III. 32:327. G. 32:355. R.H. 1908, pp. 370, 371.—In the south of England near the sea the plant thrives well, making fl.-heads 8 in. across, and with foliage as strong as that of rhubarb; it needs to be renewed from seeds. It is reported not to have succeeded at Santa Barbara. L. H. B.

MYOSÔTIS (Greek, signifying *mouse-ear*, from the leaves). *Boraginææ*. FORGET-ME-NOT. SCORPION GRASS. A large group of low perennial or annual, more or less hairy, branching, diffuse or erect herbs, inhabiting both the North and South Temperate zones, but the cultivated forms coming mainly from Europe.

Leaves alternate, entire; fls. small, in 1-sided, bractless, at first recurved, terminal racemes; calyx small, 5-cleft; corolla salverform, 5-lobed, the throat crested; stamens 5, included; ovary of 4 almost separate lobes, in fr. forming 4 smooth nutlets attached to the receptacle by their bases.—Thirty to 40 species.

The following are all hardy at the North and are grown in America mainly for out-of-door planting. The flowers are normally blue, often purple when young and turning blue with age. White-flowered forms of all the species may occur. Forget-me-nots prefer moist half-shady places, but an open sunny border will do if it is not excessively dry. The perennials are easily propagated by division or cuttings. Forget-me-nots of gardens (mostly *M. sylvatica* and *M. alpestris*) are spring-flowering, making a good combination with hyacinths, tulips and pansies, although they make attractive masses by themselves. Seeds may be sown from spring to August for the next season's bloom; the plants should have protection in winter. Early-started plants may be used for forcing in a cool greenhouse. Renew the outdoor plants often.

A. Hairs of the calyx all straight, appressed: perennials.

B. St. and lvs. densely setose-hispid with reflexed hairs.

azōrica, H. C. Wats. Decumbent at the base and diffusely branched, 1 ft. high, densely setose-hispid, with reflexed hairs; lvs. oblong, obtuse or retuse, appressed hairy above, hirsute with reflexed hairs below; racemes sub-second, dense; calyx almost 5-parted; teeth linear, spreading, clothed with erect, appressed hairs; pedicel about equalling the calyx; corolla larger than in *P. laxa*, 3-3½ lines broad, deeper indigo-blue; throat with a whitish eye. Azores. B.M. 4122. V. 6:75. J.F. 4: 340.—Suitable for planting in damp, shady soil. Var. *celéstina*, Hort., is a form with light blue fls.

BB. St. and lvs. strigose pubescent or glabrous.

C. Infl. not leafy: st. angled.

D. Calyx toothed above: fls. large.

scorpioides, Linn. (*M. palustris*, Lam.). TRUE FORGET-ME-NOT of Europe. Sts. from slender, stolon-like rootstocks, slender, decumbent, and rooting below, appressed pubescent or nearly glabrous, 6-18 in. long;

lvs. oblong-lanceolate or oblanceolate, nearly sessile; raceme loosely-flid.; pedicels in fr. much longer than the calyx, spreading; lobes of the calyx deltoid, acutish; corolla bright blue, with a yellow eye, limb flat, 3-4 lines broad; nutlets angled and keeled on the inner side. May, June. Eu., Asia. G.C. III. 22:307. Gn. 52, p. 461. G.Z. 6:144 (var. *Goeppingeri*). G. 35:489.—Requires damp, shady ground. Escaped from cult. in the eastern states. Var. *semperflorens*, Hort., is a dwarf form, 8 in. high, flowering all summer.

DD. Calyx lobed to the middle or below: fls. small.

lāxa, Lehm. Similar to the preceding species, and also rooting at the lower nodes, pubescence all appressed and scanty or wanting; racemes even more loosely-flid.;



2421. *Myosotis sylvatica*. ($\times \frac{1}{2}$)

calyx-lobes much longer, ovate-lanceolate, acute; corolla-limb smaller and concave, about 2 lines broad, paler blue; throat yellow; nutlets equally convex both sides. May, June. N. Eu., Asia, Amer.—Grows best in muddy places.

CC. Infl. leafy toward the base: st. terete.

cespitōsa, Schultz (M. *Rehsteineri*, Wartm.). Plant appressed-hairy; st. erect, terete or with short decurrent lines below lvs.; rootstocks short and clustered; lvs. linear-oblong; raceme obtuse, leafy-bracted among lower fls.; pedicels longer than 5-cleft calyx; corolla small, 2 lines diam. Swamps and inundated places. Summer. Eu.—Very similar

to *M. laxa* but said to have more terete st., more pubescence and longer pedicels.

AA. Hairs of the calyx, or at least some of them, hooked and spreading: annuals, biennials or perennials.

B. Corolla small, about 1 line broad; limb concave; calyx-hairs nearly all hooked.

arvėnsis, Lam. Annual or biennial, erect, branched, 7-20 in. high, hirsute-pubescent; lvs. oblong or oblanceolate, sessile, obtuse or acutish; raceme loosely-flid.; pedicels in fr. much longer than the calyx; calyx deeply 5-parted; lobes equal, linear, acutish; corolla blue or white, 1-1½ lines broad; nutlet convex outside, keeled inside. June-Aug. Eu., Asia.—Will grow well in dry ground.

BB. Corolla larger, 3-4 lines broad; limb flat; calyx with only the lower hairs hooked.

C. Nutlets sessile: plant hirsute and often cinereous.

D. Pedicels 1½-2 times length of calyx: plant 1-2 ft. high. *sylvatica*, Hoffm. Fig. 2121. Perennial, hirsute-pubescent, green or cinereous, erect, 1-2 ft. high, branched

above; lvs. oblong-linear or oblanceolate, nearly sessile, acutish; pedicels usually much exceeding the calyx; calyx deeply cleft, hirsute, the hairs, except a few at the base, erect and straight; racemes long and loose; corolla blue, 3-4 lines broad, with a yellow eye; nutlets more or less margined and carinate ventrally, sessile. Spring. Dry soil, Eu., N. Asia. G. 28:520.—Common in cult.

nd. *Pedicels about equalling the calyx, thicker, ascending; plant 3-8 in. high.*

alpéstris, Schmidt (*M. rupicola*, Smith). Similar to the last but dwarf, 3-8 in. high; raceme more dense with shorter thicker ascending pedicels which slightly exceed the calyx; nutlets larger. Summer. Eu. G.C. 111. 17:650. Gn.W. 25:544. S.H. 2; p. 25 (1898, f. 203) (as var. *stricta*). Gt. 1896, p. 609 (as var. *stricta*). G.W. 2:550 (as var. *stricta*). Gn. 33, p. 93.—Fls. said to be fragrant in the evening. Var. *stricta*, Hort. All the branches erect and strict; appearance peculiar. Var. *aurea*, Hort. Foliage golden yellow. Commonly cult.

cc. *Nutlets stipitate; plant appressed pubescent.*

dissitiflora, Baker. Biennial; very similar in habit to *M. sylvatica*, but lower, 6-8 in. high, whole plant clothed with erect-spreading or appressed short hairs; lvs. large, spatulate-oblong, acute, bright green; fruiting racemes more elongated; pedicels ascending or incurved, 2-3 times longer than the calyx; hooked hairs almost absent; calyx-segms. lanceolate, much longer than the tube; corolla 4-5 lines diam. The most important difference is in the nutlets, which are distinctly



stipitate. Spring. Switzerland. R.H. 1896, p. 278. S.H. 2, p. 409 (1898, fig. 385). Var. *elegantissima*, Hort. Lvs. white-edged. The name *M. elegantissima* has also been applied to forms of *M. palustris* and *M. sylvatica*.

M. Victoria is a fasciated form with hollow st., much crowded, branched, condensed and malformed infl. and irregular enlarged corolla. It is said to come true to seed. Probably derived from *M. alpéstris*. See G.C. 111. 16:159; 17:650 (1895).—*M. Witwitschii*, Boiss. & Reut. A Spanish species with large blue fls.

K. M. WIEGAND.

MYRCIARIA (name probably related to *Myrtus*). *Myrtaceæ*. Brazilian trees and shrubs, of which several species are cultivated for their fruits; sometimes united with *Eugenia*.

Leaves opposite, entire; fls. sessile or nearly so,

axillary, clustered, rarely solitary or in panicles; calyx 4-lobed; petals 4, perigynous, inserted opposite the sepals, deciduous; stamens many; filaments free, filiform; anthers oval or oblong, dehiscing longitudinally; style filiform; stigma simple, rarely capitate; ovary inferior, bilocular, with 2 ovules in each locule; disk small, rarely crowned by the persistent sepals; fr. a berry; seeds 1-4, embryo exalbuminous.—Probably 50 and more species. See *Jaboticaba*, p. 1713.

cauliflora, Berg. **JABOTICABA**. The best-known species, considered by Barbosa Rodrigues the handsomest of all the *Myrtaceæ*. Tree, up to 35 ft.; lvs. elliptical-lanceolate, acute at base and apex; calyx lobes lanceolate, ciliate; fls. shortly pedicellate, produced directly from the bark of the trunk and branches; fr. $\frac{1}{2}$ -1 $\frac{1}{2}$ in. diam., globose, purplish violet in color, exocarp astringent. Mountains of Rio de Janeiro and Minas Geraes. Pacific Garden, June 1915, p. 12.

jaboticaba, Berg. **JABOTICABA DE SÃO PAULO**. **JABOTICABA DE CABINHO**. Tree, 20-30 ft.; lvs. lanceolate or ovate-lanceolate, acute, the base obtuse; calyx lobes acute, ciliate; fls. shortly pedicellate, produced directly from the bark of the trunk and branches; fr. similar to that of *M. cauliflora* in general appearance; depressed-globose, almost black, $\frac{1}{2}$ -1 in. diam., peduncle usually longer than in *M. cauliflora*. Forests of São Paulo and Rio de Janeiro.

F. W. POPEOE.

MYRICA (ancient Greek name, possibly applied originally to the tamarisk). *Myricææ*. **WAX MYRTLE**. Ornamental woody plants grown chiefly for their handsome foliage and attractive fruits and some species for their edible fruits.

Leaves alternate, short-petioled, without stipules, entire or serrate, resinous-punctate; fls. dioecious or monoecious, without perianth, in unisexual catkins; stamens 2-16, usually 4-6; ovary 1-celled, with 2 slender filiform stigmas; fr. a drupe, dry or succulent, usually coated with a waxy exudation; nut thick-walled, 1-seeded.—About 50 species in the temperate and warmer regions of both hemispheres.

The wax myrtles are aromatic shrubs or small trees with deciduous or evergreen generally oblong leaves and inconspicuous flowers followed by ornamental grayish white or red fruits. Wax is obtained from the fruits of several species; some are cultivated for their succulent and edible fruits. The bark is astringent and used medicinally and in tanning. *Myrica Gale* and *M. carolinensis* are hardy North; *M. cerifera* is somewhat tenderer and *M. californica* is still more tender, while *M. rubra* and *M. Faya* can be grown in subtropical regions only. *M. Gale* and also *M. cerifera* prefer moist and peaty soil, while *M. carolinensis* and *M. californica* grow well in sandy and sterile soil and are widely distributed along the Atlantic and Pacific coasts respectively. Propagation is by seeds sown after maturity; also by layers, and some species, particularly *M. Gale*, by suckers.

A. *Lvs. persistent, or deciduous; fr. globular or ovoid, often coated with wax; fls. with or after the lvs.* (*Marella*.)

B. *Color of fr. grayish white; fr. dry, densely covered with wax; lvs. often deciduous; stamens 2-6.*

cerifera, Linn. (*Marella cerifera*, Small. *Cerothamnus cerifera*, Small). Fig. 2422. Slender tree, occasionally to 40 ft., nearly glabrous; lvs. persistent, oblong or oblanceolate, usually acute, cuneate at the base, coarsely serrate above the middle, or entire, dark green above, paler and sometimes pubescent beneath, golden resinous, 1-3 in. long, about $\frac{1}{2}$ in. broad; staminate aments cylindric, pistillate aments short; fr. $\frac{1}{2}$ in. across. March, April. Md. to Fla., Texas and Ark. S.S. 9:459. G.F. 7:476 (adapted in Fig. 2422).—The plant cult. as *M. cerifera* is usually the following species.

carolinensis, Mill. (*M. pensylvanica*, Lois.). *Morëlla carolinensis*, Small). BAYBERRY. Fig. 2423. Shrub, 2-8 ft. high: branchlets often pubescent: lvs. subsistent or deciduous, oblanceolate to obovate, usually obtuse or sometimes acute, cuneate at the base, entire or with a few shallow teeth above the middle,



2423. *Myrica carolinensis*.
($\times \frac{1}{2}$)

dark green and dull above, sometimes pubescent beneath, resinous, 2-4 in. long and $\frac{1}{2}$ -1 $\frac{1}{2}$ in. broad: fr. $\frac{1}{6}$ in. across. March, April; fr. in Sept., Oct. Nova Scotia to Fla. and Ala., also on the shores of Lake Erie. G.F. 7:477 (adapted in Fig. 2423). F.E. 23:825 (as *M. cerifera*).—Handsome shrub, harder than the preceding, with which it is often confused; conspicuous in winter when covered with its grayish white frs. which stay on the branches until spring.

BB. Color of fr. red: lvs. evergreen.

c. Frs. distinct in small clusters on short scaly stalks: staminate fls. in simple catkins.

californica, Cham. Slender tree, occasionally to 40 ft.: branchlets pubescent: lvs. lanceolate or oblong-lanceolate, acute, cuneate, remotely serrate, dark green and lustrous above, glabrous or puberulous beneath and marked with minute black dots, 2-4 in. long and $\frac{1}{2}$ - $\frac{3}{4}$ in. broad; stamens 5-8: fr. globose, about $\frac{1}{4}$ in. across, papillose, thinly coated with wax. May, June; fr. in Sept., falling during the winter. Wash. to Calif. S.S. 9:461. J.H.S. 1852:283.—One of the prettiest Californian native shrubs, but not easily transplanted and difficult to prop.

rubra, Sieb. & Zucc. (*M. Nagi*, DC., not Thunb.). Shrub or small tree: branchlets slightly pubescent: lvs. oblong-lanceolate, acutish, cuneate, entire or serrate above the middle, dark green above, paler beneath, glabrous, 3-5 in. long: staminate catkins cylindric; stamens 6-10: fr. globose or ovoid, tuberculate, deep red-purple, $\frac{1}{2}$ -1 in. across; stone ovoid, compressed. April, May; fr. in July. S. China, Japan. B.M. 5727. S.I.F. 2:6.—Cult. for its edible fr. There is a variety with rose-colored finer flavored fr. The berries are vinous and sweet with a pleasant acid taste and are used like blackberries; the fresh juice makes an agreeable beverage. The tree is supposed to stand about 15° of frost. Intro. in 1889. The *M. Nagi*, Thunb., is *Podocarpus Nagi*.

cc. Frs. 3-4 in small subglobose heads resembling a single 3-4-celled fr.: staminate fls. in panicles.

Faya, Ait. (*Faya fragifera*, Webb). Shrub or small tree, to 25 ft.: branches glabrous: lvs. oblong-lanceolate, acute, cuneate, entire or serrate, glabrous, 2-4 in. long: staminate fls. with 4 stamens; pistillate fls. and frs. in elongated spikes: fr. red, edible, $\frac{1}{4}$ in. across. Canary Isls., Madeira, Azores. N.D. 2:56.

AA. Lvs. deciduous: frs. inclosed by 2 persistent wing-like bracts, forming dense aroid-oblong, cane-like catkins: fls. before the lvs. (Gale.)

Gâle, Linn. (*Gâle palustris*, Chevalier). Shrub, 1-5 ft.: branches dark brown: lvs. oblanceolate, obtuse, rarely acute, cuneate, serrate toward the apex, dark green and glabrous above, usually pubescent beneath, 1-2 $\frac{1}{2}$ in. long: staminate catkins about $\frac{1}{2}$ in. long, brownish: fr. compressed, 3-pointed, yellowish, golden-resinous, in catkins about $\frac{1}{3}$ in. long, crowded at the end of last year's branches. April; fr. in Sept. N. Amer., south to Va., Mich. and Wash., Eu., N. Asia. H.W. 2, p. 97. B.B. (ed. 2) 1:584. Var. *subglabra*, Fern. Lvs. glabrous or nearly so.

M. asplenifolia, Linn.=*Comptonia asplenifolia*.—*M. sâpida*, Wall. Allied to *M. rubra*. Tree: branches pubescent: lvs. oblong to oblanceolate, 3-6 in. long: staminate fls. in panicles: fr. in elongated spikes, ellipsoid, $\frac{1}{2}$ in. long: nut pointed at both ends, edible. Himalayas, India, Malay Archipelago. Wallich, Tent. Fl. Nepal. 45.

ALFRED REHDER.

MYRICARIA (derived from *Myrica*, probably the ancient name for the tamarisk, in allusion to the close affinity of the genus to the tamarisk). *Tamaricaceæ*. A genus of about 10 species distributed from Eu. through Cent. Asia to China; closely related to *Tamarix*, chiefly distinguished by the 10 stamens being connate one-third to one-half, by the 3 sessile stigmas and the stalked tuft on hairs on the seeds. They are hardy shrubby or suffrutescent plants with alternate scale-like lvs. and with the fls. in terminal, often paniced racemes. *M. germanica*, Desv. (*Tamarix germanica*, Linn.), is a glabrous undershrub, 4-6 ft. high, with upright, wand-like branches: lvs. minute, bluish green, lanceolate, glandular-dotted: fls. light pink or whitish, in 4-6 in. long, terminal racemes, usually with lateral ones at the base; bracts produced into a narrow lanceolate point, broadly winged below, exceeding the buds; stamens connate about one-half. Cent. and S. Eu., W. Asia. S.O.B. 3:131. G.W.H. 38. *M. dahurica*, Ehrenb. (*Tamarix dahurica*, Willd.), is very similar, but racemes usually lateral, the bracts oblong-ovate, acute with a membranous margin all around, not exceeding the buds, and stamens connate only one-third. Dahuria, Transbaikalia. The cult. is the same as of tamarix; they prefer sandy, moist soil.

ALFRED REHDER.

MYRIOCEPHALUS (Greek, *ten-thousand-headed*). *Compositæ*. Annual or perennial herbs, all Australian, often hoary, especially when young.

Leaves alternate, entire: clusters or compound heads terminal, usually globose or hemispherical; heads exceedingly numerous and sessile on a broad, very flat receptacle, surrounded by a general involuere of numerous narrow bracts in many rows, each usually with a scarios tip or radiating appendage. In *M. Stuartii* these appendages are 1-2 lines long, broad, white and very conspicuous.—About 8 species.

Stuartii, Benth. (*Polycalymma Stuartii*, F. Muell. & Sond.). Pubescent or woolly, not much branched: lvs. linear or lanceolate, half st.-clasping, 1-2 in. long: clusters hemispherical, 1 in. or more across; partial heads 5-8-fld.: seeds woolly; pappus of numerous ciliate bristles.—Very rare in American collections. An odd sort of everlasting flower, known to the trade as *Polycalymma Stuartii*. It is a half-hardy plant, growing about 1 $\frac{1}{2}$ ft. high and bearing yellow and white heads.

N. TAYLOR.†

MYRIOPHYLLUM (Greek, *myriad-leaved*). *Haloragidaceæ*. PARROT'S FEATHER. Water plants, used in aquaria, fountains and pools.

One of the eight genera of the widespread water-milfoil family, other genera being *Gunnera*, *Hippuris* and *Proserpinaca*, all with minute or inconspicuous individual fls. but interesting and various in foliage. Lvs. whorled or alternate, emersed and immersed, the former entire, dentate or pinnate, the latter divided into capillary segms.; fls. usually monocious, dioecious or polygamous, in axillary clusters or spikes; calyx none, or present and minutely 2-4-lobed; petals 2-4; stamens 4-8; ovary 2-1-celled, each cell with a solitary ovule.—Species about 20, in fresh water in many parts of the world, from the tropics to the frigid zones. Various native species are likely to be transferred to ponds and aquaria.

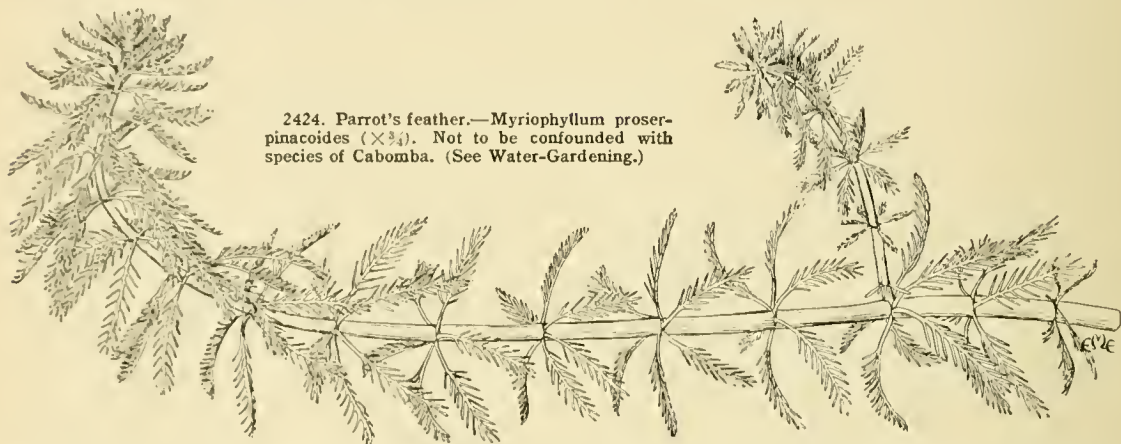
The parrot's feather is a favorite aquatic plant, with delicate feathery foliage, composed of numerous whorls of finely cut leaves. The one often seen in vases and fountains in public parks has the uncomfortable name of

stamens 4 or 6; petals rather persistent; carpels 1-2-ridged and roughened on the back. Lakes and rivers. Ont. to Fla. and Minn.

WILHELM MILLER.
L. H. B.†

MYRISTICA (Greek, alluding to the aromatic qualities of the plants). *Myristicaceæ*. NUTMEG. Myristicas are of many species, but most of the nutmegs of commerce are the product of *M. fragrans*, Houtt. (*M. moschata*, Thunb. *M. officinalis*, Linn. f. *M. aromatica*, Lam.), shown in Figs. 2425, 2426. This tree is cult. and naturalized in the W. Indies. The genus *Myristica* is the only one in the family under the old treatment, but it is now divided by Warburg into 8 genera. As delimited, *Myristica* comprises about 80 species in farther India, Austral., and Pacific Isls. As formerly defined they are dioecious trees with alternate, entire, pinnate-veined lvs., and small fls. in axillary clusters; perianth 2-4- (usually 3-) lobed, in a single series; anthers 3 or more, connate; ovary single, 1-loculed, ripening into a fleshy fr. The nutmeg of com-

2424. Parrot's feather.—*Myriophyllum proserpinacoides* (× $\frac{3}{4}$). Not to be confounded with species of *Cabomba*. (See Water-Gardening.)



Myriophyllum proserpinacoides. It is a half-hardy plant from Chile, with weak stems which grow out of the water about 6 inches. It may be planted in a water-tight hanging-basket, and if water can be kept standing on the surface, the plant will hang gracefully over the edges. Although detached floating branches will persist for some time, the plant needs earth in which to root. The other species here described are hardy plants, which are common in our eastern ponds. Any one of them may be gathered for the aquarium, and the last two are procurable from dealers in aquatics and aquarium supplies. All of them are readily propagated by long cuttings inserted in the earth or mud of the aquarium or pond. (William Tricker.)

A. Lvs. all alike.

proserpinacoides, Gill. PARROT'S FEATHER. Fig. 2424. Lvs. in whorls of 4-6, 7-12 lines long; segms. 10-25. Chile. G.W. 15, p. 680.—It has escaped from cult. in N. J., but apparently has not persisted. Differs from the 2 following in being dioecious. The female plant is the one in cult.

AA. Lvs. above the surface of the water different from those below.

B. Lvs. whorled in 3's and 4's.

verticillatum, Linn. Floral lvs. pectinate or pinnatifid, longer or shorter than the fls.; submerged lvs. in crowded whorls, the divisions very fine or slender; stamens 8; petals deciduous; carpels even. Canada and N. U. S. Eu.

BB. Lvs. whorled in 4's and 5's.

heterophyllum, Michx. Floral lvs. ovate, lanceolate, sharply serrate, or even entire, much longer than fls.:

merce is the seed. This is surrounded by a ruminated aril, which furnishes the mace of commerce. The fr. of *M. fragrans* is short-pear-shaped, to nearly globular, 1½-2 in. long, hanging, reddish or yellowish, somewhat fleshy, splitting at maturity into 2 valves and disclosing the scarlet aril or mace. Inside the aril is the hard nut or shell, and inside the shell is the nutmeg. The details of the mace and nutmeg are shown in Fig. 2426. For a full illustrated and historical account of the nutmeg, see B.M. 2756, 2757 (1827). The nutmeg has not been grown to any extent in the western hemisphere, the commercial supply of nuts and mace coming mostly from the E. Indies.

L. H. B.

The nutmeg tree requires a position in well-sheltered, hot, moist valleys in the tropics from sea-level up to 400 or 500 feet; it will grow and produce fruit in Jamaica up to 2,000 feet, but the fruit is not so abundant nor the nut so large as at lower elevations. The soil must be a deep rich loam, well drained. The seedlings have a tap-root which is very easily injured in transplanting. The method usually adopted for growing them is to sow the seeds in bamboo pots, one in each. When they are ready for planting in their permanent places, the bamboo is slit, and the soil, with the plant, gently put into the prepared hole. It is only when they first flower that it is possible to tell the sex of the tree. Nothing is known of the conditions which determine the sex. In Grenada (British West Indies), the usual proportion of male trees to female is said to be as three to one, though sometimes forty or fifty trees close together will all be either male or female. As the trees generally flower when they are six or seven years old, there is great waste in the growth of male trees. In the Botanic Gardens in Jamaica, it has been found possible to

graft the nutmeg, so that a loss of this kind should not occur again; the plan is, take young seedlings and graft, by approach, the thinnest twigs of a female tree.

WM. FAWCETT.



2425. *Myristica fragrans*—the nutmeg. The upper sprays are from the staminate tree. ($\times \frac{1}{4}$)

MYRMECÛDIA (*murmekos*, an ant; the ants nest in excavations that they make in the great tubers). *Rubiaceae*. From 20–25 remarkable epiphytic subshrubs of E. Asia and the Pacific Isls., sometimes grown by the curious. They require the treatment of epiphytic orchids. The plants are glabrous, with 4-angled thickish or fleshy branches; lvs. crowded at the ends of the branches, opposite, obovate; stipules persistent, curiously transformed into scales; fls. small, white, sessile amongst the lvs. and modified stipules. *M. Antoinii*, Becc. (*M. echinata*, Ant.). Tuber very large, 6 in. or more diam., dull gray, tuberculate and spiny; st. inclined and flexuous, 4-grooved, the ribs covered with imbricating woody shields (stipules); lvs. at top of st., 4 or 5 in. long, elliptic-ovate to obovate, acute; fls. $\frac{1}{2}$ in. long, white, sessile on the ribs; corolla clavate, 4-lobed. Torres Straits. B.M. 7517. G.W. 13, p. 117; 14, p. 524.

L. H. B.

MYROBALAN: One of the genus *Myrobalanus*, now referred to *Terminalia* (which see). **Myrobalan Plum**: *Prunus cerasifera*.

MYRÓXYLON (*myrrh wood*, from the scent). Syn. *Toluifera*. *Leguminosae*. A few balsam-bearing trees of S. Amer., scarcely cult. horticulturally. Lvs. odd-pinnate; flts. exstipellate, glandular-punctate; fls. more or less papilionaceous, white or whitish, in axillary simple racemes or paniculate at ends of branches; calyx irregularly dentate; standard orbicular; 4 inferior petals subequal, narrow and free; stamens deciduous with the petals, free or connate at base; pod stalked, compressed, indelhiscent, at the apex hardened and 1-seeded, the basal part long and narrow and 2-winged. See also *Toluifera*. *M. toluiferum*, HBK. (*Toluifera Balsamum*, Linn.). **TOLU-BALSAM TREE**. Tree, to 75 ft. or more, with thick rough bark and a straight trunk:

flts. 7–11, alternate, oblong and acuminate, quite glabrous, 2–3½ in. long; the balsam is secured from incisions in the bark. *M. peruvianum*, Linn. f. **PERU-BALSAM TREE** (but not the source of Balsam of Peru, which is from *M. Pereirae*, of San Salvador). Beautiful tree: flts. 9–13, ovate-oblong, alternate and emarginate at the apex, entire, puberulous on the midrib and petiole, punctate, 1½–3 in. long; fls. in simple racemes 4–5 in. long, long-pedicelled.

L. H. B.

MÝRRHIS (from the Greek word for perfume). *Umbelliferae*. **MYRRH**. One perennial herb native to Europe and an immigrant to other countries, sometimes grown in gardens for its pleasing scent and anciently used as a flavoring in salads. In America Myrrhis is represented by *Osmorhiza* (which some writers now call *Washingtonia*), which is known as sweet cicely. Two or three of the American plants have been named under Myrrhis, but the genus is now excluded from this country. It is closely allied to *Chærophyllum*. Technical characters distinguish the two genera.

The myrrh of the Arabs is the gum of *Balsamodendron Myrrha*, a burseraceous tree which is now referred to *Commiphora*; not in cult.

odorata, Scop. **MYRRH**. **SWEET CICELY** of Eu. Soft-hairy or pubescent, erect, branching, 2–3 ft.: lvs. thin and soft, 2–3-pinnate, with narrow-toothed or pinnatifid lanceolate segms.; fls. small, whitish, in a compound umbel which is devoid of a general involucre; fr. $\frac{1}{2}$ in. long, longitudinally ribbed. Eu. Gn. 72, p. 18. G.W. 15, p. 131.—Herbage sweet-scented. Rarely seen in this country, but interesting for its graceful foliage; seed may be sown in autumn as soon as ripe, and the plants will come up in spring; prop. also by division; the plant persists for years.

L. H. B.

MYRSINE (an old Greek name for the myrtle, of no application; the myrtle is *Myrtus communis*). *Myrsinaceae*. Shrubs and trees with coriaceous leaves and whitish or yellowish small flowers, of tropical and warm countries.

As formerly constituted and accepted by botanists, a genus of about 80 species: glabrous or tomentose; lvs. leathery, mostly entire; fls. small, sessile or peduncled, in axillary or lateral clusters, polygamo-dioecious; floral parts in 4–5's, the corolla-lobes imbricated in the bud; anthers short and usually blunt; fr. a pea-shaped drupe, dry or fleshy, 1-stoned; seed globose. The family has been re-elaborated by Mez (in *Das Pflanzenreich*, IV:236 1902), and the genus *Myrsine* is restricted to 4 species in Asia and Afr. The species here described then become *Rapanea* and *Suttonia*.

A. Fls. with separate petals. (*Suttonia*.)

Lessertiāna, A. DC. (*Suttonia Lessertiāna*, Mez). Tree, 60 ft., with trunk to 2 ft. diam. with gray bark: lvs. elliptic to obovate, sessile or short-petioled, obtuse and mostly rounded at apex, black-dotted above; fls. yellowish, with reddish dots, in fascicles in the older axils and along the branchlets and on projecting spurs; petals broad-elliptic, twice longer than calyx; drupe globose, reddish or black. Hawaii; intro. in S. Calif.



AA. Fls. gamopetalous.

guyanensis, O. Kuntze (*Rapanea guyanensis*, Aubl. *Myrsine Rapanea*, Roem. & Schult. *M. floribunda*, R. Br. *M. floridana*, A. DC.). Glabrous shrub or small tree; lvs. 3–4 in. long, mostly at ends

2426. Nutmegs. The upper specimens show the aril or mace. The lower left specimen shows the nut after the mace is removed. The lower right specimen shows part of the shell removed, disclosing the nutmeg. ($\times \frac{1}{3}$)

of branches, leathery, obovate-oblong, rounded or notched at top, revolute at margin, rusty and dotted beneath, devoid of pellucid dots; fls. sessile or very nearly so; corolla rotate, whitish, much longer than the purple-spotted sepals; drupe small ($\frac{1}{4}$ in. diam.), bluish or black. S. Fla. to Brazil and Paraguay.

L. H. B.

MYRSIPHÝLLUM: *Asparagus*.

MYRTILLOCÁCTUS (berry and cactus). *Cactàcea*. Usually large trees or shrubs with very many branches in the wild state, but in cultivation often small, with few or no branches.

Stems with few angles or ribs; fls. very small, several in a cluster, diurnal, with short tubes and widely spreading petals; fr. a small edible berry.—The genus contains 3 or 4 species.

geométrizans, Console (*Cereus geométrizans*, Mart.). Plants 10–15 ft. high; ribs 5–9, obtuse, with broad intervals; spines 3–6, the central one much longer and dagger-shaped; fr. the size of an olive, bluish, much eaten by the Mexicans. Common on the tableland of Cent. and S. Mex.



2427. *Myrtus communis*. ($\times \frac{1}{2}$)

Còchal, Brit. & Rose (*Cereus Còchal*, Oerunt). Said to grow 10 ft. high; ribs 4–8, obtuse; spines few, the central not so long as in the last; fr. said to be red. Low. Calif.—Not common, and not to be recommended for small collections.

J. N. ROSE.

MYRTLE: *Myrtus communis*. **Crape M.:** *Lagerstræmia*. **Running M.:** *Vinca minor* and others. **Sand M.:** *Leptophyllum*.

MYRTUS (*Myrtos*, the ancient Greek name). *Myrtàcæa*. MYRTLE. Mostly shrubs, grown for the aromatic qualities, attractive foliage, flowers and fruits.

Leaves opposite, entire, penniveined, usually aromatic; fls. white or rose-tinged, axillary, 1 to many, the central on short lateral or long pedicels; calyx-tube turbinate, 5- (rarely 4-) lobed, usually persistent; petals 5 (rarely 4); stamens numerous, in several rows, free; ovule 2–3-celled; fr. a berry, adnate to, or included in the calyx-tube.—A genus of perhaps 70 species, mostly subtropical natives of S. Amer. and Austral., but also in S. Eu. and W. Asia. Some of the myrtles are now referred to *Eugenia* and other genera. In common speech, the word myrtle is applied to other small-ld. evergreens as to the vincas or periwinkles.

Myrtles are grown in pots for greenhouse, window or room decorations, or in California and the South as outdoor ornamental shrubs. In pots, they make excellent lawn and terrace plants, being given protection in winter. They are easily cultivated and readily propagated from firm or partially ripened cuttings. They like an abundance of water in summer.

communis, Linn. The classic MYRTLE. Fig. 2427. A handsome evergreen shrub, 3–10 ft. or more (sometimes a small tree) high, both fls. and lvs. strongly scented; lvs. small in the variety usually cult., ovate or lanceolate, entire, smooth and shining, acute, coriaceous; peduncles solitary, 1-flid., length of lvs. or shorter, bear-

ing 2 linear bractlets below the white and reddish pretty fls.; berry blue-black. Azores to Beluchistan; well known in the Medit. region. G.C. III. 45:18.—Several varieties are cult., which differ chiefly in the shape and size of the lvs. and in stature; there is also a variegated form. Makes a good hedge in S. Fla. Ever-blooming in S. Calif. It blooms in 2–3 years from cuttings in England. Following are some of the important named forms: Var. **melanocarpa**, DC. Fr. black. Var. **leucocarpa**, DC. Fr. white. Var. **latifolia**, Hort. Lvs. very broad. G.W. 6, p. 595. Var. **microphylla**, Hort. Lvs. small, dark green, linear-lanceolate and long-pointed. Var. **mucronata**, Linn. Lvs. linear-lanceolate, acuminate. Var. **lusitânica**, Linn. Lvs. lanceolate-ovate, acute. Var. **italica**, Mill. Shoots or branches nearly or quite erect, the lvs. rather small, ovate-lanceolate, sharp-pointed. Var. **boëtica**, Mill. Branches short, lvs. crowded and thickish rather large, broadly ovate-lanceolate. Var. **bélgica**, Mill. Lvs. broad-lanceolate, long-sharp-pointed. Var. **angustifolia**, Hort. Lvs. medium size, lanceolate. Var. **româna**, Mill. Lvs. broad-ovate, large, sharp-pointed, light green, often 3–4 at a node. Var. **tarentina**, Mill. Shoots short, lvs. ranged in 4 rows, short, ovate, sharp-pointed. Of some of the above, there are forms with variegated and white-margined lvs. and double forms. The different manifestations of *Myrtus communis* appear not to have been given adequate trial. It is not unlikely that the summers are too hot for them even where the winters are not too frosty; but there must be localities where they can be grown and treatments under protection of buildings or walls that would cause them to thrive. In ancient times, wreaths of myrtle were worn by magistrates and by victors. The plant yields perfumery, and the green and dried frs. are sometimes used as condiments. The wood is very hard and of interesting texture and grain.

Arayán, HBK. Lvs. 1–2 in. long, ovate-oblong, acute, membranaceous, reticulate, glabrous and shining; pedicels axillary, solitary, 1-flid., 2-bracted; fls. size of *M. communis*; calyx 5-parted; fr. globose, red, 2-celled and 2-seeded. Peru.—Listed in S. Calif.

Úgni, Molina (*Eugenia Úgni*, Hook. & Arn. *Úgni Molina*, Turcz.). UGNI OF CHILEAN GUAVA. As usually seen under cult., a shrub 4 ft. high, but in its native habitat it is said to become a tree 100 ft. high; pedicels 1-flid.; berry purple, glossy, edible, with a pleasant odor and taste. Chile; hardy in S. Calif. B.M. 4626. R.H. t879, p. 409.—Wood very hard and heavy, much used in Chile for press-screws, and select implements.

M. Lima—*Eugenia apiculata*, p. 1163.—*M. macrophylla*, Spreng.—*Eugenia malaccensis*, p. 1163.—*M. tomentosa*, Soland.—*Rhodomyrtus tomentosa*.

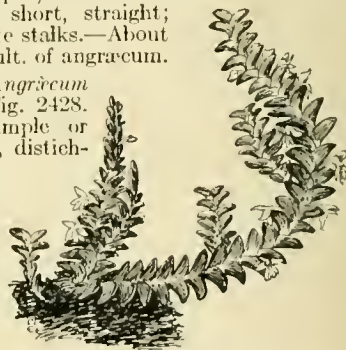
J. BURTT DAVY. L. II. B.†

MYSTACÍDIUM (Greek, on account of bearded appendages of the column). *Orchidàcæa*. In habit resembling *Angraecum*. Sepals and petals similar, lip immovably attached to base of column, furnished with a long thin basal spur, either entire or 3-lobed; column short, straight; pollina upon 2 separate stalks.—About 20 species, in Afr. Cult. of angraecum.

distichum, Pfitz. (*Angraecum distichum*, Lindl.). Fig. 2428. Sts. 3–6 in. long, simple or branched; lvs. fleshy, distichous, grooved above, laterally compressed; fls. axillary, small, white. Sierra Leone. B. M. 4145. B. R. 1781.

M. gracillimum, Rolfe. Scapes very slender; fls. white; spur long and very slender. Uganda.

GEORGE V. NASH.



2428. *Mystacidium distichum*. ($\times \frac{1}{2}$)

N

NAEGÈLIA (Karl von Naegeli, once professor of botany at Munich). *Gesneriaceae*. Trop. American herbs allied to *Achimenes*, but the fls. arranged alternately in a leafless terminal panicle (in *Achimenes* the fls. are axillary). In cult., the plants are oftener called gesnerias than naegelias, but they are distinguished from that genus in usually having an annular or ring-like disk at the base of the corolla, rather than a deeply lobed disk. Tubers usually none, the plant rhizomatous or repent: st. nearly simple: lvs. opposite, soft, long-petioled, usually cordate: fls. showy, mostly red, sometimes yellowish white or suffused, alternate in a terminal cluster with very small bracts at base of pedicels; corolla declined or hanging, oblique and usually more or less spotted in throat, much exceeding calyx.—Species about a half-dozen, Mex. and Cent. Amer. *Naegelia* hybridize with other gesnerias. One hybrid race is known as *Naegelio-Achimenes* and another (F.S. 10: 957, 958) as *Mandirola*. Because of the panicle fls., *naegelias* are very ornamental plants. They are warm-house subjects, prop. by stolons or offsets.

Because of conflict with another genus of the same name, Kuntze proposes the name *Smithiantha* for this genus; but the way seems to be clear for the use of the well-established *Naegelia*. See *Smithiantha*.

In general, the cultural methods given under *Achimenes* (Volume I, page 206) suit *naegelias* well (compare also *Gloxinia*). The roots should be stored in the pots in which they have been grown. It is a poor plan to keep any bulbs or tubers of the *Gesneriaceae* in dry sand in a dry storeroom. After being well ripened, *naegelia* roots should be kept in the greenhouse under the benches. Keep them out of the drip, but water them occasionally. (T. D. Hatfield.)

A. Fls. nearly scarlet, or brick-red, marked with white.

cinnabarina, Lind. (*Gesneria cinnabarina*, Lind. *Smithiantha cinnabarina*, Kuntze). Fine winter-blooming plant, 1½–2 ft. tall, soft-hairy: lvs. round-ovate and cordate, crenate-dentate, thickish, green, with red or purplish hairs: fls. about 1½ in. long, hanging on the ends of spreading pedicels, gibbous-tubular to the very base, the calyx-lobes acute and spreading, the short corolla-lobes unequal and obtuse, the fl. cinnabar-red or nearly scarlet on the upper side, but paler and spotted on the under side. Mex. B.M. 5036. Lowe, 33. H.F. II. 5:4 (var. *rosca*).

AA. Fls. orange-scarlet or scarlet, marked with yellow.

zebrina, Regel (*Gesneria zebrina*, Paxt. *Smithiantha zebrina*, Kuntze). Fig. 2429. Much like the above, but brighter colored, red-dotted below and yellow within and on the under side: calyx-lobes short and appressed; corolla contracted toward the base, whereas they are gibbous or swollen to the very base in *N. cinnabarina*. Brazil. B.M. 3910. B.R. 28:16. P.M. 8:271.—A fine plant, of which there are several forms. The commonest species. Names belonging here are *Gesneria regalis* and *G. splendens*.

achimenoides, Bart. (*Smithiantha achimenoides*, Fritsch). Hybrid of *N. zebrina* and *Achimenes* or *Gloxinia* (said to be with *A. glabrata*; see *Gloxinia*, Vol. III, p. 1350): fls. very large (often 2 in. long), yellowish rose on the outside, yellow and rose-spotted on the inside, the segms. clear rose.

AAA. Fls. white, cream-color or rose.

multiflora, Hook. (*N. amabilis*, Decne. *Smithiantha amabilis*, Kuntze. *Gesneria amabilis*, Hort.). Fls. white or cream-color, numerous, hanging, the tube curved and not much swollen, the obtuse lobes subequal: plant bearing long, glandular hairs in addition to the velvety covering: otherwise much like *N. zebrina*. Mex. B.M. 5083. F.S. 12:1192 (as *Achimenes* [*Naegelia*] *amabilis*). G.C. III. 22:413. Gn. W. 23:335. G. 22:631.—The tenable name of this species is sometimes held to be DeCaisne's *N. amabilis*, which goes back to 1857, but *Gloxinia multiflora*, Mart. & Gal., dates from 1842.

hyacinthina, Carr. Of horticultural origin, probably a hybrid: fls. white or rose, in a very compact pyramidal panicle. R.H. 1877, p. 29.

N. fulgida, Ort. Fls. vermilion: lvs. large, oval, deeply toothed. Mex.—*N. Geroltiana*, Regel (*Smithiantha Geroltiana*, Kuntze). Continuous-flowering plant, allied to *N. zebrina*. Mex. F.S. 2:97.—*N. sceptre coral*, Carr. Fls. many in an open panicle, cinnabar-red, yellow-spotted inside. R.H. 1869, p. 154 and col. pl. For pictures of varieties and hybrids, see F. S. 16:1671–1672; 10:987–988.

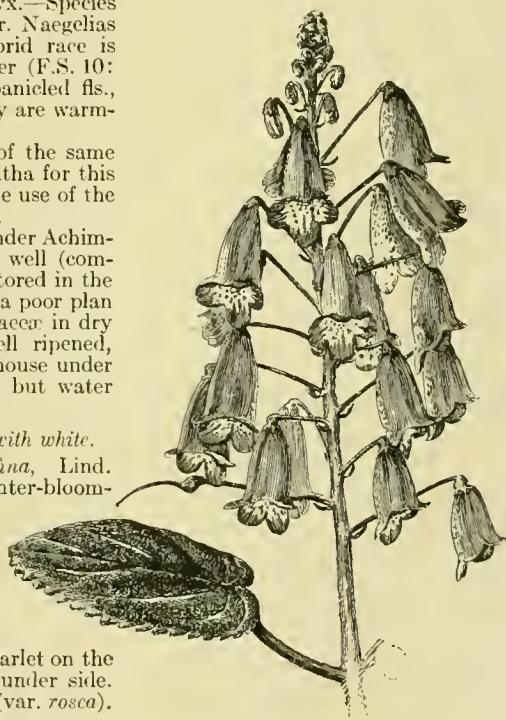
L. H. B.

NAEGÈLIO-ACHIMENES is a former trade name mentioned under *Naegelia*.

NĀMA (Greek, a stream or spring, referring to habitat of the first-described species). *Hydrophyllaceae*. Low herbs or subshrubs, little known in planting.

Annual and perennial, sometimes spiny: lvs. mostly alternate, entire, dentate or crenulate: fls. blue or white, solitary or in various clusters; corolla campanulate or nearly salverform to funnel-shaped or somewhat rotate, 5-lobed; stamens 5, inserted in base of corolla-tube, the filaments usually dilated or appendaged at base; styles 2, with small capitate stigmas: fr. a membranaceous ovoid or subglobose dehiscent caps.—Species 36, as defined by Brand in *Das Pflanzenreich*, hft. 59 (IV. 251: 1913), mostly in W. N. Amer. and Mex., but also in W. Indies, S. Amer., and 1 in Hawaii. One species is offered as a garden plant in Calif.

Párryi, Gray (*Eriodictyon Párryi*, Greene). Shrubby perennial, 3–6 ft., stove, the st. over ½ in. diam.: lvs. many, dark green, linear or linear-lanceolate, dentate



2429. *Naegelia zebrina*. (×½)

or undulate, villous, sessile; fls. violet-blue in small lateral clusters that are aggregated into a long terminal spike or narrow thyrse; sepals oblong-lanceolate; corolla tubular-funnelform, about $\frac{1}{2}$ in. long. Calif. May-July.

L. H. B.

NAMES AND NOMENCLATURE. Every plant that is known and recorded must have a name or appellation; the system or scheme of naming is known as nomenclature (pronounced nô-men-clature).

It is now the universal custom with botanists to name a plant with two words,—one designating the genus or group into which it falls, and the other distinguishing the particular plant from all other plants in the group. The genus or group may be *Rubus*, the raspberries, blackberries and dewberries; the particular species of *Rubus* may be *villosus*; and the complete name is therefore *Rubus villosus*. It will be seen, therefore, that this two-word or binomial appellation both classifies and names the plant. When other species of *Rubus* are discovered, they receive special, or specific, names in the genus, as *R. frondosus*, *R. allegheniensis*, *R. Millspaughii*.

In scientific language, a plant may have only one name. Confusion would arise if it had two or more. But it sometimes happens that two or more persons give a name to the same species (either because unaware

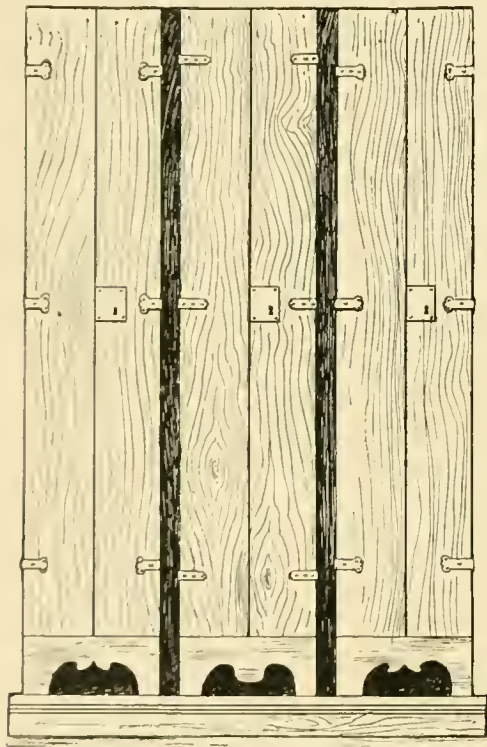
may be a very different plant; but only the oldest name, if it is the proper or accepted genus, may stand, and all other names become synonymous or duplicates. It happens that the *Rubus villosus*, Gray, is not a species so named by Gray in ignorance of Aiton's name, but a misapplication of Aiton's *R. villosus* to another species than that which Aiton had in hand, as will be understood from the narrative below.

It would seem to the layman to be the simplest matter to make the name *Rubus villosus*—*villosus* is only a Latin word signifying "hairy;"—but, in fact, it is a serious undertaking. It is always considered the mark of a good botanist that he make new names with the greatest caution. In the first place, it is allowable to make a name only when the plant is nameless. When the botanist finds a plant that he suspects to be new, he must exercise all reasonable caution to determine whether anyone in all the world has named it. He must determine its genus, and be able to write a sufficient description of it. He must give it a name that has not been used before in that genus: if any plant has been named *Rubus villosus*, he cannot give another *Rubus* that name. Then he must publish the name and description in some publication of recognized standing; and once published, it is established in botanical literature and neither he nor anyone else can ever modify it. Always is his own name associated with the name of the plant; and if the name is an error or the description inaccurate, he must take the responsibility so long as botanical literature shall last.

The description is made for the purpose of enabling anyone to identify the plant. Amongst the hosts of plants, however, the confusion may be so great that even the best description will not positively identify the plant. A picture will help, and illustrations are often published when the plant is first described. But a poor picture may be misleading and thereby be worse than none. Every botanist, therefore, preserves a specimen or specimens as a type of his new species. This specimen is dried, "mounted" or stuck on a sheet of stiff white paper, and laid away in the herbarium. Custom dictates that this sheet of paper shall be about $11\frac{1}{2}$ inches wide and $16\frac{3}{8}$ inches long; and only one species is glued on a sheet (see *Herbarium*, Volume III). In case of dispute, this type specimen is consulted, and it takes precedence over descriptions and pictures. It alone is final, as determining what plant the author meant to designate by the name. Even the author himself cannot ignore or replace the original "type specimen;" it is part of the ethics of the profession that this specimen shall not be destroyed or modified. So it happens that type specimens become increasingly valuable as time goes on.

The larger part of the new species are "made" or described at the great centers of botanical study, and the specimens are preserved in these public or semi-public collections; but any botanist anywhere may describe a new species, in which case he may send his type specimen or an authentic duplicate of it to one of the great herbaria, where it may be consulted by other students; and at his death his collections are likely to find their way to one of the botanical centers.

In all the great collections, quantities of unnamed or undetermined specimens may accumulate, particularly from travelers in little-frequented regions. In time, some student of the flora of the region may study these specimens, perhaps finding undescribed species among them; or a student of one special group may go over them to find the plants that fall within the range of his studies; or if the given accumulation is interesting and valuable in itself, some student may study it as a collection and publish on it, describing new species, adding to the descriptions of recognized species, and correcting ranges and habitats. Specimens and even whole collections are sometimes loaned to reputable students of special groups. These specimens are always to be



2430. Some of the cases in which is kept the priceless herbarium of Linnaeus.

of an earlier name or because the authors regarded a given form of the plant as a distinct species or as separate enough to receive another name), and to distinguish one name from another the author's name goes with the plant-name that he makes. So it comes that "*Rubus villosus*, Ait.," means that the name *Rubus villosus* was made by Aiton. Botanists know when and what Aiton wrote: therefore they can trace the name and description to its source. "*Rubus villosus*, Gray,"

returned without subtraction, injury or modification. Very often the student, in returning the specimens, adds material of his own to enrich the collection. It will be seen, therefore, that the herbarium becomes more precious year after year as successive students contribute their interpretations to it.

While the above outline may seem to make the naming of plants a relatively simple and direct process, nevertheless many complications and confusions may arise. First of these difficulties are the varying interpretations placed on the specimens by the different students, some of them regarding differences as having specific value (wide enough to justify the separation of the material into two or more species) whereas others may consider them to be only variations within the species. The process of combining, separating and recombining introduces many names of different relative values, all of which must be considered and accounted for by subsequent students or authors. Again, older authors may be found, in books or publications overlooked, who have made names and descriptions. Or the rules of nomenclature accepted by different botanists may not be harmonious, and the differences must be adjusted as completely as possible. There may be different standards or conceptions of genera between different authors, resulting in shift and re-shift from genus to genus. These and other situations make the subject of botanical nomenclature very complicated.

Some of the inharmonies in nomenclature have been resolved by the action of botanical congresses, but there is yet wide divergence in practice and it is difficult to foresee any close agreement even in the formal rules and precepts, while it is scarcely to be expected that concurrence can be attained in the underlying concepts as to what are species and what are not, although it ought not to be impossible to reach something like a uniformity on genera.

The situation of this Cyclopaedia.

A cyclopaedia of horticulture includes species from around the world, deriving its names and descriptions from the publications of many countries; its nomenclatorial method should be international so far as such a method exists. Therefore, this Cyclopaedia follows, as a policy, the regulations of the International Botanical Congress held in Vienna in 1905 (see page xi, Volume I). It would not be desirable, as it would also not be practically possible, to endeavor in a compilation of this kind, and for popular use, to recombine the names of plants from all over the world to conform to any special or regional school of nomenclature.

The Cyclopaedia is not primarily a botanical treatise. Its first obligation is to the horticultural fraternity, to those who apply and use the results of botanical study. It must regard the value of names that are long established in commerce and in literature. Binomial names do not belong exclusively to botanists. There is merit in usage and in the end it controls. Whenever all botanists of authority agree upon a set of changes, the horticulturists should of course adopt them; but a cyclopaedia of this kind is not under obligation to be "up to date" in respect to recent changes that may represent only individual opinion or which are likely to be overturned or at least not adopted by other botanists of standing. So far as possible, a cyclopaedia of horticulture should represent settled practices. This work, therefore, adopts a conservative attitude in nomenclature.

The International or so-called Vienna rules contain regulations or "articles," and recommendations. The articles deal with the principles, and the recommendations with cases and practices. The articles are broadly stated and often allow of considerable latitude of application; and the recommendations are left to the option of the author. Therefore, the application of the Vienna Rules is not invariable.

But other and somewhat opposite considerations weigh in the compilation of the Cyclopaedia, seeing that many authors contribute. While it is desired that all these authors conform as nearly as practicable to one system, nevertheless the author himself, when he is a special and authoritative student of the group, must be



2431. Linnæus' Sheet of *Rubus canadensis*.

allowed to use his preferred method even though the combined result as between the different articles should prove to be somewhat inharmonious. A distinction is clearly to be made between work that is compilatory and editorial, and that which is the result of original studies with the material; the former may follow the accepted method of the Cyclopaedia, but the latter may follow the method of the particular author's monographic work. Thus it is, for example, that the citrous tribes, the cacti, and some of the groups of trees and shrubs, present such wide departures.

It has been the desire, however, to avoid the making of new binomials or combinations, for the cyclopaedia is not intended as a "place of publication" of botanical names. In the course of the work, however, it has been impossible to avoid re-combinations in some cases and yet present the subjects acceptably.

Double citation of authorities for botanical names has been avoided. This is in the interest of simplicity and convenience. The double citation is for the use of botanists to aid them in tracing the history of the name. The identification of a name by citing the author of it, is one thing; the record of the history of a name in the double citation is quite another thing. But whatever the justification in technical botanical work, the gardener and the horticulturist in general should not be burdened with these details, particularly when they are cumbersome and awkward in themselves. Thus, *Lippia nodiflora*, Michx., is sufficient for our purpose, showing that Michaux first used this combination; the double citation is *L. nodiflora*, (Linn.) Michx., show-

ing that the use of *nodiflora* as a name for this plant began with Linnaeus under another genus, although the double citation does not indicate the number of transfers from genus to genus that may have been made in the meantime.

In the prefatory pages to Volume I, the method of nomenclature employed in this Cyclopædia is briefly stated; but it may be well to make an explanation of the use of capital letters in specific names. It is the rule in English that proper adjectives are capitalized, as American, African, Canadian. This is not the practice in all other languages, however. For the sake of uniformity, it is now the practice with many authors to decapitalize all specific names. The specific name should agree with its genus in gender; but some of the old

substantive or generic names are used as specific names in defiance of gender terminations, and the use of the capital letter explains the exception. Thus *Dracocephalum Moldavica* indicates that *Moldavica* is an old substantive (used once as a genus) and is used in apposition and not as an adjective; otherwise it would be *D. moldavicum*, meaning the moldavian dracocephalum. Other substantives are not Latin and cannot be Latinized, as *Dolichos Lablab*; the word *Lablab* is not an adjective qualifying *Dolichos*. Bearing these distinctions in mind, such names as *Campanula Medium*, *Dioscora Bataas*, *Cornus Amomum*, *Schinus Molle*, *Mapania Pandanophyllum* are understood. The Vienna Code makes a recommendation on the use of capitals: "Specific names begin with a small letter except those which are taken from names of persons (substantives or adjectives) or those which are taken from generic names (substantives or adjectives)." Under this recommendation, descriptive names are not capitalized. A special category are the geographical names, but they may be fairly regarded as descriptive and be used with small letters; this is the practice in this Cyclopædia, for the purpose of conforming to the recommendation. A few confusions arise in decapitalizing geographical names. For example, *Syringa persica*, one of the lilacs, takes the small p because the name means Persian; whereas *Prunus Persica*, the peach, takes the large P because the word was once used for a genus (*Persica vulgaris*, the peach), although that generic word was derived from the country Persia whence the peach was supposed, at that time, to have come. In some cases, the same or similar specific names may be personal or geographical, and many geographical names are derived directly from persons, as Bolivia, Rhodesia, Colombia, America; but in practice little or no confusion arises. The practice in this Cyclopædia, then, is to capitalize specific names derived from persons (either in the genitive as *Hookeri*, or in adjective as *Hookeriana*), and all substantives used in apposition, as *Pyrus*

Malus, *Alpinia Allughas*, *Vaccinium Vitis-Idæa*, *Phlox Stellaria*, *Ipomæa Nil*, *Polygonum Posumbu*.

How a plant is named.

A personal narrative may illustrate some of the complexities in nomenclature. The case that is here chosen for elucidation is not more interesting or important than scores of others that might be taken from the experiences of botanists, but it will afford an example.

Blackberries and dewberries (which are of the genus *Rubus*) are variable. This is the botanist's way of saying that there are many intermediate forms and that it is difficult to distinguish one kind from another. On different soils and in different places, the plants look different. They may intergrade. With them, evolution

has probably not yet proceeded far enough to obliterate the intermediates, and the "missing links" may not have disappeared. The species are not "well marked." Therefore it is not strange that botanists disagree as to what are species and what are varieties of species. What one botanist calls a species of *Rubus*, another prefers to call a variety, or a mere "form" perhaps due to influence of soil, elevation or exposure. The general tendency is to make more species in all genera than did the old botanists, because we know the plants more intimately and recognize differences that were not seen or understood one hundred years and more ago. What Linnaeus thought was one species we may now think is several; and if we break up his one species into several, we must know which one of these forms he had, in order that we may retain his name for it;—and we determine this fact by consulting his herbarium (if a specimen is preserved) which is now in London.

Or, again, we may misunderstand what Linnaeus meant to designate by a given name, and may use his name for a different plant from that which he had in mind. Even if we see his specimen, we may make an error in identifying it,—for it is not always an easy matter positively to identify and classify a dried specimen, particularly if the specimen was fragmentary or poor in the beginning or has become broken or insect-eaten. It sometimes happens, therefore, that when two men examine the type specimen of a "critical" species, they arrive at different conclusions as to what that species is. Each may publish his views, applying the name as seems right to him, and botanists choose the one determination or the other according as they accept one man or the other. The naming of plants, therefore, is not an exact procedure.

The name "*Rubus villosus*" is one that Aiton gave in 1789 to a plant that grew in the gardens at Kew, near London. The plant, he said, came from America. It was described in brief Latin phrase, with little indication as to its habit of growth. Before this time, even



2432. Aiton's sheet of *Rubus villosus*, preserved in London.

as early as 1753, Linnaeus, the great Swede, had described a blackberry, which the traveler Kalm had discovered in Canada, as *Rubus canadensis*, the "Canadian rubus." In 1809, Willdenow, a Prussian systematist, described *Rubus inermis*, from specimens growing in the Botanic Garden at Berlin, said to have come from America; and in 1822, Link, also of Berlin, described, under similar circumstances, a plant that he called *Rubus argutus*. When American botanists began to write books, in the early part of the nineteenth century, two well-marked species of blackberries were made out,—one a trailing plant or dewberry, and the other an upright plant or high-bush blackberry. The descriptions given by Linnaeus and Aiton were looked up and compared: the *Rubus canadensis* of Linnaeus was thought to designate the dewberry, and the *Rubus villosus* of Aiton the high-bush blackberry. Since there were only two wild blackberries, the names made by Willdenow and Link must be mere duplicates; and they were regarded as synonyms of *Rubus villosus*, having no standing in the manuals.

Years passed. Botanists found that the rubuses did not match the descriptions in the books and they seemed to "run into each other," so that they could not be clearly separated or told apart. Therefore they were not carefully studied, for it has been the history of botany that the "best defined" species have usually been collected most freely, so completely have we been dominated by the old idea of the original entity of species. But gradually the dried specimens accumulated in the herbaria. One by one the puzzling genera were taken up for study. Finally *Rubus* had its turn.

It was found that there are several species of blackberry-like plants growing wild in the eastern states, rather than two. Amongst the rest was found a thornless blackberry in the mountains of West Virginia, and in 1891 it was named *Rubus Millspaughii*, in honor of C. F. Millspaugh, its discoverer. Thereupon botanists searched their herbaria, and sprigs of the plant were found, under various names, representing collections from Canada to Carolina. But there were still other species than this, and it began to be seen that the botany of American rubi is complex. This fact should have been no surprise, for the European species of rubi have long been known to be amongst the most puzzling of plants. What should be the names of these newly understood species? Linnaeus and Aiton were consulted, but their descriptions did not distinguish. The type specimens must be seen.

It seemed to fall to the writer to undertake the inquiry. To see the two dried plants of Linnaeus and Aiton did not seem worth a trip to Europe. Therefore an artist near London was engaged to make a drawing of Linnaeus' specimen in the rooms of the Linnaean Society, in Picadilly, and of Aiton's in the Natural

History Museum at South Kensington, London. These pictures gave such unmistakable evidence that we had misunderstood these old botanists, that it seemed desirable not to publish the results until the specimens had been examined. The picture of Linnaeus' plant left little doubt as to the identity of the species that he had, but that of Aiton's was a puzzle, for it seemed to represent clearly no American blackberry.

In the Linnaean herbarium is the sheet of *Rubus canadensis* (Fig. 2431), supposed for nearly a century and a half to represent the common running dewberries of the fields, but which was identified to be in reality the *Rubus Millspaughii* of recent years. From the time that Peter Kalm collected the plant in Canada before the middle of the eighteenth century until 1891, this plant

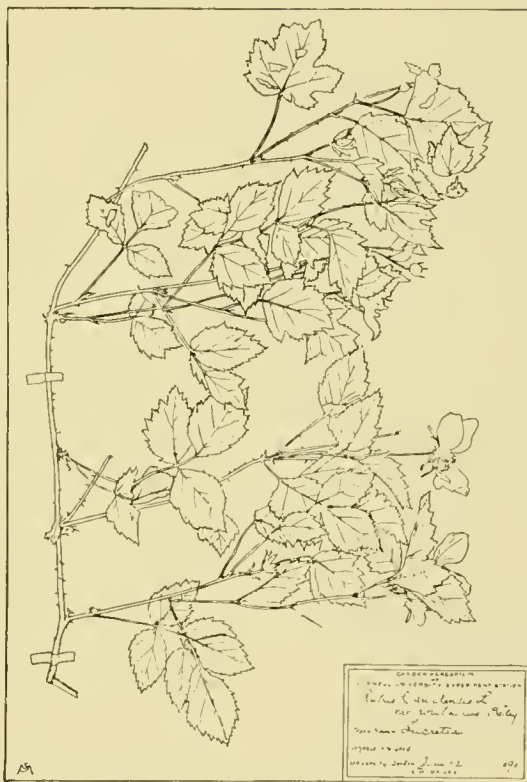
had been overlooked. Now, therefore, this thornless blackberry must be known as *Rubus canadensis*, and the name *Rubus Millspaughii* becomes a duplicate or synonym having historic and literary value, but no longer to be used, if the determination is correct, as the name of the plant. In the meantime, the common dewberry, erroneously known as *Rubus canadensis*, is left without a name.

In the collections of Aiton is his specimen of *Rubus villosus* (Fig. 2432). It is difficult to determine just what this plant is, because the specimen was taken from the tip of a strong verdurous shoot, and therefore does not represent the usual form of any blackberry as seen in herbaria. It is, in fact, the tip of a prostrate shoot of the common dewberry, the very plant to which we had supposed Linnaeus gave the name *Rubus canadensis*. The dewberry (Fig. 2433), therefore, must be called *Rubus villosus*, notwithstanding the fact that the name itself is not specially appropriate; but the tips of strong shoots—rarely mentioned in descriptions—are

somewhat hairy. But a name is a name, not a description; and even though it is inappropriate as to the attribute it seems to ascribe to a plant, it still serves all the purposes of a designation. This unrepresentative specimen proved to be very puzzling; and a year later it was re-examined; and in the collection at South Kensington specimens were deposited of the tip growths of the dewberry which are good counterparts of Aiton's old type.

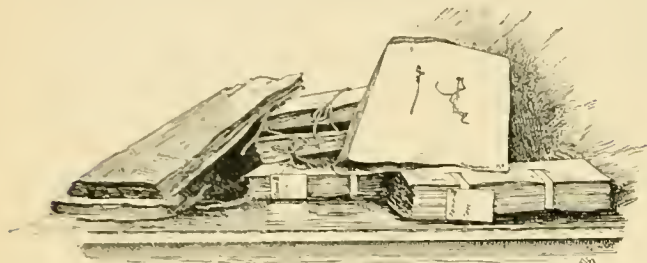
The thornless blackberry and the dewberry were now provided with names; but the common high-bush blackberry of east-American fields, which we had been accustomed to call *Rubus villosus*, was left nameless.

In the effort to find a name for the high-bush blackberry, the *Rubus* names given by Willdenow and Link must be accounted for. The descriptions made by these authors are not sufficient positively to determine the plants. The dried specimens themselves must be seen in Berlin. Willdenow's name, *Rubus inermis*, suggests that it may have been applied to the thornless



2433. An herbarium sheet of a form (var. *roribaccus*) of *Rubus villosus*.

blackberry, for *inermis* means "without thorns." In the great herbarium at the Botanical Garden, Willdenow's plants are preserved in stout blue paper wrappers (Fig. 2434). His *Rubus inermis* is amongst them (Fig. 2435), but it turns out to be a blackberry of Greece. In the old garden at Berlin, early in the century, American and European plants were growing, each species occupying a little space of earth and marked by a stake label. In time, one of the American plants



2434. Bundles from the herbarium of Willdenow.

probably had perished and a Grecian plant occupied its place, growing behind an American stake. Specimens of the plant were taken for the herbarium, and not recognizing it as an American plant, Willdenow described it as a new species; but before his time this Grecian plant had been described as *Rubus ulmifolius*—the "elm-leaved rubus"—and Willdenow's name, supposedly applied to an American plant, now becomes a synonym of a European species.

Willdenow's name having failed us, we next take up Link's *Rubus argutus* (Fig. 2436), and here is still another difficulty; it is an American plant, but of a distinct species from the high-bush blackberry. Other names, not mentioned in this account, must be considered.—Trattinnick's, with specimens in Vienna, Michaux's in Paris, Bigelow's of Boston, and others. All were looked up, and none of them could be applied to the common blackberry, and the plant was given a new name, *Rubus nigrobaccus*.

It must not be supposed, however, that the case was now disposed of and settled. Every subsequent student has the liberty of his own interpretation. Some botanists consider the common *Rubus nigrobaccus* to be but a form of *R. allegheniensis* of Porter, a name which dates from 1896 whereas *R. nigrobaccus* dates from 1898; in this case, *R. allegheniensis* holds and *R. nigrobaccus* becomes a synonym. So all the other forms may be separately judged, and every author has the right to his own judgment and to the use of the name that goes with it. Other interpretations have been made more recently as to the species-lines in *Rubus*. In a group so difficult and variable as *Rubus*, the judgments naturally will be diverse and agreement is not to be expected, perhaps not even to be desired.

(See name lists, end Vol. VI.)

L. H. B.

Historical development of botanical nomenclature.

The present universally accepted binomial nomenclature started in 1753 with the publication of Linnaeus' "Species Plantarum," when for the first time all known plants were named according to a uniform system based on the principle that for the designation of a plant two names, a generic and a specific, each consisting of one word only, should be sufficient.

Before that time there was no uniformity in naming plants; most of them were designated by longer or shorter descriptive phrases, as *Aralia caule aculeata*, *Narcissus niveus odoratus circulo rubello*, *Mespilus aprifolia virginiana spinis horrida fructu amplo coccineo*, *Acer foliis palmato-angulatis floribus subapetalis ses-*

silibus fructu pedunculato corymboso; others by a single Latin or vernacular name, some by common nouns like *Centrum galli*, *Corona imperialis*, *Capillus Veneris*; not unfrequently the descriptive phrase was reduced to one word, as in *Iris germanica*, *Nymphaea lutea*, *Berberis vulgaris*, combinations which were already in use in the sixteenth century. This more or less lawless naming is usually referred to as pre-Linnaean nomenclature. Its beginnings may be traced back more than 2,000 years to the writings of Theophrastus (371–286 B. C.), a disciple of Aristotle, to the works of Pliny (33–79 A. D.), and of Dioscorides, who lived at nearly the same time, and to other ancient writers. Later writers on natural history and medicine up to the fifteenth century added little to the knowledge of the plant world; their writings consisted chiefly of commentaries to the classical works and of scholastic discussions on the meaning and application of the names used by the ancient writers and on the medical virtues of the plants as set forth by them. A new era started in the beginning of the sixteenth century when men like Brunfels, whose "Herbarum Vivae Eicones" appeared in 1530, Bock, Fuchs and Cordus, began to study

the native plants and found that many of them were unknown to the old writers; they published figures drawn from nature and descriptions of these new plants and gave new names to them. The coming of botanical names derived from personal names was inaugurated at that time, and Conrad Gesner (1516–1563) was probably the first one to name plants in compliment to his friends, e. g., *Cortusa*, *Aretia*, *Vollata* and others. A fairly complete enumeration of the plant names with their synonyms known up to 1623 was published in that year by Caspar Bauhin in his "Pinax Theatri Botanici;" this work shows the extent of the botanical knowledge at that time and is valuable as a key to the nomenclature of the older writers.

Progress in nomenclature is hardly possible without classification. In the earlier works the plants were either enumerated alphabetically or roughly divided into trees, shrubs and herbs or arranged according to their uses. One of the first attempts toward classification was made by Cesalpini in his "De Plantis Libri XVI" (1583), who arranged the plants roughly according to their fruits. Other more natural systems and at the same time a clearer conception of genera and species were introduced by Jung, Morison, Ray and Rivinus.

Morison was the first botanist to publish a monographic treatment of a natural group in his "Plantarum Umbelliferarum Distributio Nova" (1672). Ray in his "Methodus Plantarum Nova" (1682) distinguished families like Labiatae, Papilionaceae, Siliquosae (Cruciferae), Grasses, Monopetalae, while Rivinus based his classification chiefly on the corolla and distinguished Monopetalae with regular and with irregular flowers and Pentapetalae and Tetrapetalae with the same subdivisions. The older writers had often united under one generic name very different plants: e. g., *Clematis sylvatica latifolia* (= *Clematis Vitalba*), *C. daphnoides* (= *Vinea minor*), *Clematis tetraphylla* (= *Bignonia caprolata*), *C. indica* (= *Passiflora*); and as another example, *Viola Martia purpurea* (= *V. odorata*), *V. matronalis* (= *Hesperis matronalis*), *V. lunaria* (= *Lunaria rediviva*). The botanists named above, in consequence of their better understanding of natural affinities, proved the unnatural character of such genera and divided them into different genera under distinct names.

In 1700, Tournefort published in his "Institutiones Rei Herbariae" a complete enumeration of all the known genera with descriptions and illustrations; he is considered the founder of the modern conception of the genus and of its nomenclature, and therefore the year 1700 has been proposed by some botanists as the starting-point for generic nomenclature. Tournefort,

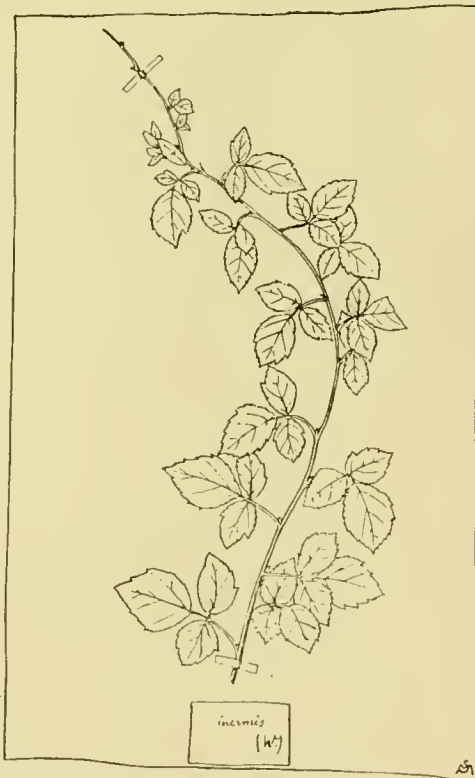
however, still retained a few of the inconvenient generic names which consisted of two words, as *Corona imperialis*, *Centaurium minus* and *Centaurium majus*, *Ferrum equinum*. These disappeared forever with the publication of Linnaeus' "Genera Plantarum" in 1737, which contained, like Tournefort's work, a complete enumeration of the known genera, but much clearer and more concisely characterized and arranged according to the sexual system of which Linnaeus had published an outline two years before. About the same time, in 1736 and 1737, Linnaeus laid down his principles of botanical nomenclature in his "Fundamenta Botanica" and "Critica Botanica," but it was not until 1753 that he took the last step in his reform of botanical nomenclature and proposed for each known species a *nomen triviale*, that is a name which consisted of a single word and was intended to replace for general use and reference the cumbersome descriptive phrases previously used.

This simplified and convenient nomenclature found the speedy approval of nearly all botanists and was soon universally adopted. Very few botanical works of importance were published after that time which did not accept the binomial nomenclature; the most notable are perhaps Patrick Browne's "Civil and Natural History of Jamaica" (1756), and the sixth edition of Philip Miller's "Gardeners' Dictionary" (1759), but in the seventh edition (1768) Miller adopted the binomial nomenclature. Although little or no objection was raised against the nomenclatorial system itself, many attempts were made to change specific and also generic names for various reasons; for example, Salisbury in his "Prodromus Stirpium in Horto ad Chapel Allerton Vigintium" (1796) conceived the idea that all specific names ought to be descriptive adjectives and therefore changed names like *Lonicera Caprifolium* to *L. suavis*, *L. Periclymenum* to *L. odora*, *Rhamnus Frangula* to *R. nemoralis*, and others. Likewise many other botanists felt themselves at liberty to change names they did not like or did not consider quite correct, and the law of priority had little weight up to the first quarter of last century. The general tendency was then, and in fact has been for a much longer time, to give preference to names published in important and easily accessible works and to follow the lead of men considered to be great authorities. Fortunately, nearly all great systematic botanists, about the middle of last century, as the De Candolles, Endlicher, Martius, Hooker, Bentham, Asa Gray, Baillon, were more or less guided by the law of priority, but with the increasing botanical activity about that time the necessity was felt to have definite and uniform rules for the ever-increasing number of botanical workers. Therefore Alphonse De Candolle was charged to prepare for the International Botanical Congress at Paris in 1867 a code embodying the rules to be followed in botanical nomenclature. The code which was presented to the Congress and adopted contained as the fundamental principle the strict observation of the law of priority. It ruled that in transferring a species from one genus to another the oldest specific name had to be preserved; also that in changing a variety to a species or *vice versa* the oldest name must be retained. Although most continental botanists followed more or less this Paris Code, or as it is sometimes called Candollean Code, the British botanists under the leadership of Kew preferred the first combination under the correct genus, the so-called Kew rule. The Paris Code, however, even by its professed adherents, was hardly ever applied consistently in all its consequences. This was pointed out forcibly by Otto Kuntze in his "Revisio Generum," of which the first part appeared in 1891; in this work he essayed a rigid application of the Paris Code, resulting in thousands of new combinations under hundreds of unfamiliar generic names. This avalanche of new names raised a storm of protest in many quarters. For years Kuntze

fought for the strict application of the Paris Code of which he proposed several amendments, and for the acknowledgement of his new names, but his uncompromising and unyielding attitude and the often intemperate language used against those in opposition made him many enemies, and he therefore did not accomplish so much as he might have effected, if he had tried more persuasive methods; but nevertheless he set the reform under way.

In 1892 the Botanical Club of the American Association for the Advancement of Science at the Rochester meeting drew up a short code of eight articles, somewhat amended at the Madison (Wisconsin) meeting the following year, which embodied about the same rules as were contained in the more amplified Philadelphia Code of 1905. In the following year, the International Botanical Congress at Genoa added a few but rather unimportant amendments to the Paris Code. In 1897, the botanists of the Berlin Botanical Museum agreed on a set of rules mainly for the guidance of the collaborators of Engler & Prantl's "Natürliche Pflanzenfamilien." The chief feature of these rules was a provision against replacing well-known generic names by old half-forgotten names which had failed to become established within fifty years after their publication, thereby allowing the principle of usage to predominate in certain cases over the principle of priority.

In 1900, at the International Botanical Congress at Paris, a commission was formed to make the necessary



2435. Willdenow's specimen of *Rubus inermis*, in Berlin.

arrangements for a representative meeting of botanists at the time of the Congress at Vienna in 1905 to come to some agreement on the fundamental rules of nomenclature. Botanists of the whole world were invited to make propositions and amendments to the Paris Code, which had been decided upon as the base of the new code. Propositions were freely offered, and all were incorporated in a publication which was sent to lead-

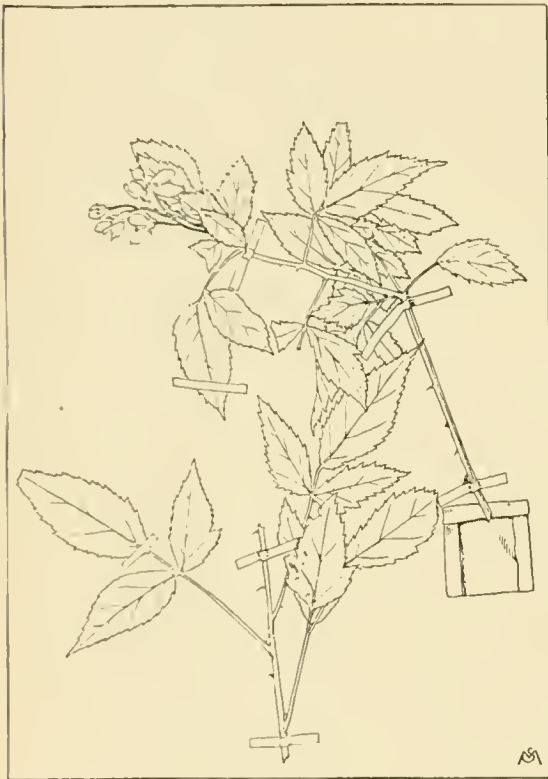
ing botanical institutions and to those botanists who had offered propositions. During the Congress the different propositions were discussed and voted upon by a representative gathering of botanists of the whole world in special nomenclatorial sessions which extended through a whole week. The new code, which was the result of this Congress, is known as the International Rules, sometimes called Vienna Code.

The fundamental principle of this code is the acceptance of the law of priority with 1753 as the starting-point for the nomenclature of the vascular plants. However, to avoid disadvantageous changes in the names of well-known genera, a list of about 400 generic names, "nomina conservanda," was provided which

ought to be avoided. The whole code contains fifty-eight articles and thirty-seven recommendations. It gives detailed rules for the formation of names, citation of authors, validity of genera, species and varieties, transfer of species and varieties, changes of names, rejection of names, and other practices. A conveniently accessible reprint of the English version of the code will be found in *Rhodora* 9:33-55 (1907). There are also German, French and English versions in "Verhandlungen des Internationalen Botanischen Kongresses in Wien 1905," published in 1906 by Gustav Fischer in Jena.

A number of American botanists had submitted to the Congress an entirely new code and proposed that it should be accepted instead of amending the Paris Code. This, however, could not be done, as it was understood from the beginning that the new code should be based on the Paris Code. After the Congress, the authors and supporters of this new code came together and voted not to accept the decision of the International Congress, but to retain their code, which is known as the Philadelphia Code or American Code. Only in one point was a change introduced and the decision of the Vienna Congress followed, namely, that specific and varietal names cannot compete with each other. In the Philadelphia Code, much stress is laid on the method of types, to which little attention is paid in the International Rules. Besides this the following points are the most important in which the two codes differ. The Philadelphia Code recognizes no exceptions in the priority of generic names; it has no list of "nomina conservanda." In the case of union of group-names published at the same time in the same book, those having precedence of position in the publication or on the page are regarded as having priority. A name or combination of names can never be used a second time for a different group, while according to the International Rules it can be used again if the older is not valid. In transferring a specific name to another genus, repetition is allowed, which makes names like *Glaucium Glaucium* and *Symphoricarpos Symphoricarpos* admissible. The use of the genitive and the adjective form of the same personal name for different species in the same genus is not admissible, while according to the International Rules they cannot be rejected, e.g., *Lysimachia Hemsleyi* and *L. Hemsleyana* are admissible according to the International Rules, but not according to the Philadelphia Code. The whole Philadelphia Code contains nineteen canons, besides rules on orthography, citation, and other matters. It is published in the *Bull. Torr. Bot. Club.* 34:167-178 (1907).

In 1910, the International Botanical Congress held at Brussels added several amendments to the International Rules and fixed the starting points for the nomenclature of the lower cryptogamous plants. In conjunction with this congress, an International Horticultural Congress was held, of which a subsection on nomenclature was charged to consider nomenclatorial questions in regard to horticulture. It was resolved that the International Rules should be accepted with a few exceptions and modifications concerning the nomenclature of horticultural varieties and hybrids. The employment of Latin names for horticultural forms is restricted to descriptive terms like *compactus*, *nanus*, *fastigiatus*; other names ought to be given in a vulgar tongue and must not be translated when transferred to other languages; the names should be expressed so far as possible in one word, the employment of three words to be the maximum. Bigeneric hybrids ought to receive a generic name formed by the combination of the generic names of the parents into a single word, while according to the International Rules they must be placed under one of the parent genera. Trigeneric hybrids are preferably designated by affixing the ending *ara* to a personal name. (See *Adamara*, *Linncara*, *Louviara*.) The Horticultural Code consists of sixteen



2436. The sheet of Link's *Rubus argutus* in the herbarium at Berlin.

must be retained in all cases. The oldest specific name, under whatever genus it had been published, is to be preserved in transferring a species from one genus into another except when the same combination already exists in the new genus, e.g., *Azalea pontica*, if transferred to *Rhododendron* cannot become *R. ponticum*, as this combination already exists for another species in the genus. Also a specific name must be changed if it repeats simply the generic name in the new genus, e.g., the specific name of *Bignonia Catalpa* when transferred to *Catalpa* must be changed, as *Catalpa Catalpa* is not admissible. Varietal and specific names cannot compete with each other; that is, for a variety the oldest varietal name given under any other species or genus holds, even if there should be an older specific name for the same plant, and *vice versa*. Under the Paris Code, however, the oldest name must be retained in any case whether published as a specific or as a varietal name. When two or more groups with names of the same date are united, the author chooses. A name or combination of names which is universally regarded as a synonym may be used again for another plant, although it

articles; the English version of it will be found in the Jour. Roy. Hort. Soc. 37:149-151 (October, 1911).

The International Rules have been adopted and are followed by nearly all botanists of the Old World and of this continent outside of the United States. In England there are perhaps a few who still follow the Kew rule, and an example of a very recent horticultural book in which this rule is adhered to is Bean's "Hardy Trees and Shrubs." In Germany there is one horticultural writer, A. Voss, who holds to the Paris Code as amended by O. Kuntze, as appears from his botanical contributions to the "Landlexikon" edited by K. von Putnitz & L. Meyer and in course of publication. In this country, a large number of botanists have adopted the International Rules, but the greater part follow the Philadelphia Code. The differences that the application of these codes produces on the nomenclature of our native plants may readily be seen by comparing the two manuals of the flora of northeastern North America, namely the seventh edition of Gray's Manual by Fernald and Robinson and the second edition of Britton's Manual; the first follows the International Rules the second the Philadelphia Code.

An interesting secession from the Philadelphia Code is constituted by E. L. Greene and two or three other botanists; they do not recognize any fixed starting point in botanical nomenclature and go back to Theophrastus, Dioscorides and Pliny, accepting the occasional binomial names found in the works of pre-Linnaean writers. They quote, e. g., *Populus nigra*, Pliny; *Hesperis hortensis*, C. Bauhin; *Rorella Cordi*, Lobelius (= *Drosera rotundifolia*); *Bucanephyllum americanum*, Plukenet (= *Sarraenia purpurea*); *Spiraea*, Theophrastus. Other examples may be found in articles published in the "American Midland Naturalist."

It is to be hoped that there will be no more secessions from the two chief nomenclatorial codes, but that instead the followers of these two codes will find, by mutual concessions, some common ground to agree on a universal code acceptable to all botanists of the world.

ALFRED REHDER.

NANDINA (Japanese name). *Berberidaceæ*. A small, tender shrub with bright red or white berries, said to be cultivated in every little garden in Japan.

Erect plant: sts. about as thick as a finger: foliage evergreen, graceful at all times, twice or thrice ternately cut; lfts. entire: young growth prettily tinged with red, and the bases of the lower stalks often swollen into red globular bodies: fls. small, numerous, white and panicle. It agrees with the common barberries in having 6 stamens and an indehiscent berry, but the fls. are differently colored and the sepals more numerous. There are about 6 petals, but the numerous sepals gradually pass into petals, the outer ones being small, green and leathery, the inner larger and whiter: ovules 2, ascending from the base: berries red, in clusters terminating the branches, handsome.—Species 1, *N. domestica*, Thunb. Japan and China. B.M. 1109. Gn. 23, p. 329; 58, p. 13. G.M. 51:665. G. 29:43.

This shrub is rarely grown North under glass. Pot-grown plants or seeds are procurable from Japanese dealers. The seeds are said to be of an uncommon shape, being convex on one side and concave on the other. Ernest Brauntun writes as follows about the plant in California: "*Nandina domestica* is an old-time favorite in southern California, ultimately reaching to 8 feet in height, though of slow growth. For a few years past its use in local gardens has steadily increased and bids fair to rival that accorded it in Japan, where it is to be found in nearly every garden. It grows well in whole or partial shade and if well supplied with water does equally well in the hottest sunshine. If used in sunny position it will be found to thrive best when planted in lawns, evidently needing more atmospheric humidity than our climate naturally affords.

Its terminal trusses of white flowers, followed by brilliant scarlet berries, added to a winter change of foliage from green to red, unite to make it an interesting and attractive shrub throughout the year." The plant is held in great reverence in China; it there withstands considerable frost when the wood is well ripened.

WILHELM MILLER.

NANNORHOPS (*dwarf bush*, because of its low stature). *Palmaceæ*. One tufted small fan-ld. palm, Afghanistan and India, *N. Ritchiana*, Wendl., scarcely cult. St. or rhizome prostrate, several feet long, branched: lvs. rigid, plicate, with whitish powder, the segms. curved and 2-lobed, the petiole unarmed (and thereby distinguished from *Chamærops humilis*): spadix much branched: spathes tubular and sheathing: fls. polygamous; corolla 3-parted; stamens 6-9; fr. a small globose or oblong 1-seeded drupe the size of a grape. G.C. III. 51:66.

In the mountains of Afghanistan it grows where covered with snow in winter. In sheltered places there it reaches a height of 15-25 ft.: lvs. 3 ft. long, the petiole half as long as the blade, the 8-15 lf.-divisions 1 ft. long. The hard bony seed is said to be surrounded with an edible pulp.

L. H. B.

NANODES (a *pigmy*: the plants are small). *Orchidaceæ*. Two or 3 epiphytic S. American orchids now referred to Epidendrum. In that genus it forms a section or subgenus, with lip adnate to column, and 4 pollen-masses on ovate glands. *E. Medusæ*, Pfitz. (*Nanodes Medusæ*, Reicheb. f.), from the Andes, is a very singular fleshy-stemmed pendent orchid with distichous imbricated, twisted glaucous lvs., and 2 or more large terminal fls. with greenish sepals and petals shaded dark brown, and a fringed dark purple lip: pseudobulb about 1 ft. long. B.M. 5723, where Hooker remarks: "Amongst the many bizarre fls. which Orchideæ present, few are more singular than this Nanodes, to which Mr. Reichenbach has most felicitously given the name of *Medusæ*. Altogether the flattened, stout culms, and the extraordinary appearance and lurid purple of the flower give it a most sinister appearance, and, for an orchid, a most unusual one." *E. Mathewsii*, Reicheb. f. (*Nanodes Mathewsii*, Rolfe). Rhizome creeping, many-rooted: st. nearly erect: lvs. linear, acute, canaliculate at base, distichous: fl. single, large; sepals lance-acuminate; petals linear, acute; lip emarginate. Peru.

L. H. B.

NAPÆA (name refers to a *glade* or *dell*). *Malvaceæ*. One species, *N. dioica*, Linn., a rough-pubescent perennial herb, 5-9 ft. high, st. nearly simple, growing in valleys and bottom-lands, Pa. to Minn. and Tenn., said to be sometimes cult. for ornament. The fls. are small, white, in terminal corymbs, dioecious, the staminate with 15-20 anthers and the fertile with sterile stamens and an 8-10-carpelled ovary; petals entire; calyx 5-toothed and no involucre: lvs. large, the radical ones often 1 ft. or more across, palmately 9-11-cleft and the lobes pinnatifid. This plant is not to be confounded with *Sida Napæa* (or properly *S. hermaphrodita*), of similar range and habit and said also to be cult. in old gardens, but which has hermaphrodite fls. See *Sida*.

NAPOLEONA (after Napoleon Bonaparte). *Lecythidaceæ*. A small but botanically remarkable genus of Trop. W. Afr., very little known in cult. and demanding no treatment here. The fls. are of interesting structure. They are shaped like a saucer, about 2 in. diam., and the dominant color is reddish and bluish. The petals, staminodia and stamens are in 4 concentric rows, and more or less joined at the base to form the saucer or cup; the petals, on the outside, are connate and form a circular membrane or rim with many folds: the staminodia, free or nearly so, form a second row; the third row of connate staminodia; inner row of

good stamens also connate at base. In the Flora of Trop. Afr. the fls. are said to be red, white or blue. Elsewhere it is stated that the fls. turn bluish as they decay. The names and illustrations of the species are confused. The names met in horticultural literature are *N. imperialis*, Beauv., *N. Heudelotii*, Juss., *N. Whitfieldii*, Lem., *N. Minuti*, Miers, *N. cuspidata*, Miers, *N. Miersii*, Hook. f. In B.M. 7199, some of the synonymy of the species is explained, with references to figures.

NARCISSUS (name probably derived from the story of the youth Narcissus, in mythology). *Amaryllidaceæ*.

NARCISSUS, DAFFODIL. Well known and desirable mostly spring-blooming bulbs, hardy and also used for forcing.

Plants with tunicated bulbs, from which arise the foliage and the fl.-scapes: lvs. linear or even subulate, usually appearing with the bloom: fls. white, yellow or seldom green, erect or pendent, solitary or umbellate on the top of the scape or peduncle, the spathe 1-lvd. and membranous; perianth salverform, the tube varying in shape, the 6 segms. equal or nearly so and ascending, spreading or reflexed, the throat bearing a corona or crown which is long and tubular (trumpet daffodils), or cup-shaped, or reduced to a ring; stamens 6, attached in the perianth-tube, the filaments short or long; ovary 3-celled, the style filiform and the small stigma 3-lobed: caps. membranous, loculicidal, bearing globose or angled seeds.—The species of *Narcissus* grow natively

in Cent. Eu. and the Medit. region and eastward through Asia to China and Japan. Many species-names are in the literature, most of them representing variants or hybrids, for the plants are extensively cult. and have received much attention from fanciers; probably 25 or 30 species represent the original stocks. The prominent species-types from the horticultural point of view are *N. Pseudo-Narcissus* (the common daffodil), *N. Bulbocodium* (hoop-petticoat daffodil), *N. Tazetta* (polyanthus narcissus), *N.*



2437. *Narcissus Bulbocodium* var. *monophyllus*. ($\times 2\frac{1}{2}$)

Jonquilla (Jonquil), *N. poeticus* (poet's narcissus).

It is customary to throw the cultivated narcissi into three main groups, founded on the length or size of the crown or cup in the perianth: I. The true daffodils or trumpets (*Magnicoronati*; Figs. 2437–2442), those with crowns equaling or surpassing the perianth-segments in length; here belong *N. Pseudo-Narcissus*, *N. Bulbocodium*. II. The star-narcissi or chalice-flowers (*Medicoronati*; Figs. 2443–2446), with crowns about half the length of the segments, as *N. triandrus*, *N. incomparabilis*. III. The true narcissi (*Parvicoronati*; Figs. 2447–2450), in which the crown is very short or reduced to a rim, as *N. poeticus*, *N. Jonquilla* and *N. Tazetta*. With the introduction of hybrid races, this old and usual classification becomes confused. It is suggested, therefore, by S. Eugene Bourne, an English authority, in "The Garden," "that the first step to an improved classification—a step which requires a very slight alteration in the present system—should be to form group I exclusively of true daffodils, and group III exclusively of true narcissi. All seedlings resulting from the union of two true daffodils should be placed

in group I, all those from the union of two true narcissi in group III. All cross-bred forms containing both true daffodil and true narcissus blood should be put with the two species of intermediate character, *Triandrus* and *Junceifolius*, in group II, to be called, perhaps, intermediate narcissi. In subdividing this middle group, forms having special characteristics must be carefully distinguished from each other (for example, hybrids of *Triandrus* from hybrids of *Poeticus*, and so on), but subject to such distinctions, arbitrary crown-perianth measurements would be usefully employed." Discarding, for the garden forms, the older grouping into the three crown-lengths, the Royal Horticultural Society recently adopted eleven groups of *Narcissi*, as follows (subdivisions omitted except in I):

- I. **TRUMPET DAFFODILS.** Trumpet or crown as long as or longer than the perianth-segments.
Yellow.—Perianth and trumpet yellow.
White.—Perianth and trumpet white.
Bicolor.—Perianth white, trumpet yellow.
- II. **INCOMPARABILIS.** Cup or crown not less than one-third but less than equal to the length of the perianth-segments.
- III. **BARRII.** Cup or crown less than one-third the length of the perianth-segments.
- IV. **LEEDSII.** Perianth white, and cup or crown white, cream or pale citron, sometimes tinged with pink or apricot; embracing different dimensions.
- V. **TRIANDRUS HYBRIDS.**
- VI. **CYCLAMINEUS HYBRIDS.**
- VII. **JONQUILLA HYBRIDS.**
- VIII. **TAZETTA AND TAZETTA HYBRIDS.**
Poetaz.—Hybrids between *Poeticus* and *Polyanthus* sorts.
- IX. **POETICUS VARIETIES.**
- X. **DOUBLE VARIETIES.**
- XI. **VARIOUS.** To include *N. Bulbocodium*, *N. cyclamineus*, *N. triandrus*, *N. junceifolius*, *N. Jonquilla*, *N. Tazetta* (sp.), *N. viridiflorus*, etc.

In the present account, it is desired to keep the type-species in view, and therefore a botanical classification is followed. In this systematic treatment, use has been made of Bourne's "Book of the Daffodil," although it is founded on Baker's "Handbook of the *Amaryllidaceæ*." A "Key to the Daffodils" by Wilhelm Miller and Leonard Barron in Kirby's "Daffodils, Narcissus and How to Grow Them," New York, 1907, arranges the species and the main garden races. In this systematic account, only the main types or well-recognized races are described; other forms will be found in the supplementary list at the end of the article.

Into the second or medium-crowned group may be placed a number of good and popular horticultural strains which are actually or presumably hybrids between long-crowns (or trumpets) and short-crowns. Very likely *N. incomparabilis* and *N. odoratus* are themselves hybrid series. Forms of *N. triandrus* might very well be classed with the long-crowns. The other garden series in this group are undoubtedly of hybrid origin, as: *N. Barrii* (Fig. 2446) had yielded about fifty named forms when Baker wrote in 1888. It is one-flowered: perianth-segments spreading, somewhat imbricated, to $1\frac{1}{4}$ inches long, sulfur-yellow, twice or more the length of the crown, the latter somewhat expanded, yellow and more or less margined with darker yellow or red. *N. Leedsii* is one-flowered: flowers slightly drooping, with spreading milk-white segments twice or more the length of cup-shaped, very pale yellow crown, which usually changes to white. Other group-series, as *N. Humei*, *N. tridymus*, *N. Backhousei*, will be found in the supplementary list (page 2113).

The narcissi are among the most popular of all spring-flowering plants, being mostly hardy, free-blooming and showy, and of interesting forms and colors. There are a few autumn-bloomers in the genus, but these are little known horticulturally. They are *N. viridiflorus*, *N. serotinus* and *N. elegans*. The hybrid narcissi have now introduced many forms, and races of varieties, and the nomenclature is mixed; but these forms and tribes add greatly to the resources of the cultivator. In this country, there is less amateur interest in the group than in European countries, although some of the kinds are forced in great quantities and many of them are widely popular among planters.

Narcissus has an interesting literature. Some of the older standard works in English are Burbidge's "The Narcissus," with many colored plates, and Peter Barr's "Ye Narcissus or Daffodyl Flowre, and hys Roots." Haworth wrote a monograph of narcissi in 1831, in which he made sixteen genera of the plants that are now referred to Narcissus. For 300 years and more, some of the species have been known as cultivated plants, and the literature runs through all the gardening books and periodicals. The number of good illustrations is also very large; some of the available portraits of the species and varieties in recent periodical literature are indicated in the systematic account herewith under the names that they bear in the journals. Some of the pictures used in this article are adapted from G.F. 5:209-13.

Usual outdoor culture of Narcissus. (J. N. Gerard.)

The narcissi are among the oldest of cultivated plants, but were much neglected for many years. Within the last twenty-five to thirty years there has spread a renewed interest in the group, with the usual result in such cases that the habitats have been closely searched for new forms, and hybrids have been raised till we have now a surprising number of beautiful flowers. Recently many of these have become so plentiful that they are within reach of the most impecunious gardener, and there is no reason why American gardens should not be filled with good collections of these beautiful flowers, or why florists should not force a more interesting list.

With few exceptions, the narcissi are hardy and strong-growing under ordinary cultivation. The "bunch-flowered" or polyanthus narcissi (*N. Tazetta*) and corbularias (*N. Bulbocodium*) are better grown under glass. The moschatus varieties, which are white (or properly sulfur-white) forms, seem to be of rather tender constitution in most gardens. Otherwise the narcissi as a rule succeed in good turfy loam, but no manure, rotted or otherwise, must touch the bulbs. Of course drainage should be good, and moisture plentiful in the growing season. In the garden it is well to plant very strong bulbs say 6 or 8 inches deep, and 3 inches at most apart, and allow them to remain till they form strong groups, or until they show signs of too much exhaustion from numerous offsets. Weak or small bulbs should not go so deep. It is advised to cover the bulbs once and one-half their own depth or size, measuring the solid body part of the bulb and not the soft neck or top. They may be placed a little deeper in light soils. The large bulbs may be 4 to 6 inches apart, and the smaller ones 3 to 4 inches. As decaying foliage is unsightly in the garden, a good plan is to dress the beds in the fall with rich manure, either animal or chemical, and in early spring start seedlings of annuals to cover the beds when the narcissi are through flowering, the dressing being necessary for the sustenance of the double crop. Too strong cultivation of the narcissi is not to be recommended, an extra vigor of growth being detrimental to the purity of the color of the flowers. If the object is to increase one's stock as quickly as possible, biennial or even annual lifting and

separation of bulbs is advantageous. For naturalizing in waste places, in the grass, or near water, many of the strong-growing kinds will succeed perfectly.

The proper time to plant is in late summer or early autumn, and the poeticus kinds should not be kept out of ground longer than possible. Knob-like excrescences at the base of the bulbs indicate that growth is beginning and that planting should not be delayed. Partial shade, or at least protection from midday sun, is desirable, as the blooms last longer, and the colors are likely to be better. The old-fashioned or unimproved kinds will last for many years, but the more highly developed strains may need renewal every three or four years.

A most satisfactory planting of narcissi for house decoration is the use of flat lily pots, say 8 inches in diameter, placing the bulbs close together. The flowers carry best and keep better if cut when half open.

The intending collector will perhaps be confused when he opens a list of say 200 varieties, and it may be as well to say that a moderate beginning may be made by choosing a few of each section into which these are usually divided in good lists, bearing in mind that price is not an indication of the beauty or usefulness. As a matter of fact, the lower price is usually an indication that these are not uncertain and are probably more valuable in the garden.

Narcissi for naturalizing and bedding. (David Lumsden.)

Many attempts have been made to naturalize the narcissi in this country. Often, however, very little success has been achieved. The difficulties are due in a measure, first, to climatic conditions, the very dry summer weather being apparently detrimental to their growth; second, the cultural treatment afforded the plants. The former can be overcome to a considerable degree by planting the bulbs in a cool sheltered position where they will not be exposed to the prevailing dry winds. The latter difficulty can be remedied by changing cultural methods. Frequently the bulbs are placed in a lawn, and as soon as their flowering period is over the foliage is cut down to the ground. This practice is to be condemned as it seriously impairs the vitality of the plants, and in a comparatively few years they succumb. When naturalization of bulbs in the grass is desired, a part of the estate or grounds should be taken where the grass may remain unclipped until the ripening period of the bulbs approaches. This period is readily discernible, as the foliage will develop a yellow hue and wither. It is then that the grass may be mown and the bulbs will suffer no injury.

In colonizing narcissi bulbs, it is advisable to plant early in autumn or as soon as the bulbs are received, which is usually the month of October. The bulbs should be set 4 to 6 inches deep, the larger sorts 5 to 6 inches apart; and the smaller species and varieties 3 to 4 inches apart. The plants may be massed by the side of ponds or streams, along sides of shady, or partially



2438. *Narcissus pseudo-narcissus*. ($\times \frac{1}{3}$)

shady, walks. Planting in open, bleak, and especially in windy situations, should be avoided. Under trees, the bulbs are likely to be short-lived unless they are well supplied with moisture and available food.

Bedding.—The daffodil lends itself admirably to formal bedding work, and it is especially attractive when planted in combination with other bulbous or spring-bedding plants, such as *Scilla sibirica* or *Myosotis scorpioides*, the blue flowers of the scillas or myosotis making an attractive groundwork in contrast with the golden yellow trumpets of the daffodils. The daffodil also stands cold weather well and will recuperate after being subjected to a late spring freeze, showing no apparent sign of injury.

List of narcissi arranged in order for successional blooming in beds, border and garden.

By careful selection, narcissi may be had in bloom from the early part of April through the month of May. Some allowance must be made for abnormal seasons, late planting and uncongenial soils. In the following list, arrangement is made according to the order of earliness. The narcissus season in the northern states is April and May. Species and varieties marked (a) are early flowering; (b) second early; (c) intermediate; (d) late; (e) very late.

SECTION I. LARGE TRUMPET CLASS.

(a) *Narcissus Pseudo-Narcissus* (Lent lily).

minimus	tortuosus	obvallaris (Tenby
princeps	Golden Spur	daffodil)
		Henry Irving

(b) *Narcissus Pseudo-Narcissus*.

Horsfieldii	maximus	Victoria
King Alfred		

(c) *Narcissus Bulbocodium* (the hoop-petticoat daffodil).

Narcissus Pseudo-Narcissus.

Emperor	Empress	J. B. M. Camm
Rugilobus		

(d) *Narcissus Pseudo-Narcissus*.

Glory of Leiden	Madame de Graaff	Madame Plomp
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(e) *Narcissus Pseudo-Narcissus*.

Grande

SECTION II. MEDIUM-CROWNED CLASS.

(b) *Narcissus Leedsii*.

amabilis	Beatrice
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(c) *Narcissus Leedsii*, *Barrii* and others.

Duchesse de Brabant	Duchess of Westminster	Grand Duchess
Mrs. Langtry		White Lady
C. J. Backhouse	Minnie Hume	Sir Watkin
Stella	Cynosure	

(d) *Narcissus Leedsii*, *Barrii* and others.

Barrii conspicuus	Flora Wilson	Barbara Holmes
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SECTION III. SMALL-CROWNED CLASS.

(d) *Narcissus Burbidgei*.

(e) *Narcissus poeticus*.

recurvus	King Edward VII	ornatus
(pheasant's eye)		
Patellaris		

SECTION IV. POETICUS-TAZETTA CLASS (POETAZ).

(d) *Narcissus poetaz*.

Alsace	Aspasia	Elvira
Ideal	Irene	Klondyke

The forcing of narcissi under glass. (David Lumsden.)

Of late years the forcing of narcissi under glass has assumed immense proportions. Tens of thousands of these bulbs are forced annually by many of the larger

florists' establishments in this country. With few exceptions, these bulbs are imported, France and Holland supplying the major part. The earlier species, such as *Narcissus Pseudo-Narcissus* var. *obvallaris* (trumpet), *N. Pseudo-Narcissus* var. *spurius*, Golden Spur, and *N. Tazetta* var. *papyraceus* (paper-white narcissus), are received from France and arrive early in August, while the larger importations of the various species are received from Holland the latter part of September. The French bulbs therefore give the earlier bloom.

When the bulbs arrive, they should at once be placed in the pots or boxes in which they are to be grown. Immediate potting is a necessity, as the flowering quality of a bulb is greatly impaired if it is kept out of the soil any great length of time. This is especially true if the bulb is exposed to the influence of a dry warm office or storeroom. If the bulbs are to be grown for home or conservatory decoration, a pot or pan, preferably 6 to 8 inches in diameter, is used, five to nine bulbs being placed in each, according to the size of the bulbs. If grown in boxes for cut-flowers, 24 by 12 by 3 inches is a convenient size to handle.

The soil should be rich and composed of two-thirds good garden loam and one-third leaf-mold or well-decayed stable-manure, with an admixture of sand sufficient to keep the compost open. The pots should be well drained with crocks or cinders, and the soil pressed firmly around the bulbs, leaving the tips just visible. Allow $\frac{1}{2}$ inch of space between the top of the soil and the top of the pot to insure that the plants are well watered when being forced. When the bulbs are potted they should be placed close together in a cold-pit or frame and given a thorough watering, covering them at once with 5 or 6 inches of screened cinders or sand, which acts as a non-conductor. The object of this is to keep them from drying out, and at the same time to maintain a low temperature which will induce them to develop good root-action. Before removing any bulbs from the coldframe or pit to the forcing-house, it is imperative that they be well rooted, as many of the failures in bulb-forcing are due to disregard of this essential precaution. A temperature of 55° to 60° F. at night in the forcing-house will be adequate. It will require four to six weeks' forcing to bring the bulbs into flower, depending in a measure on the season and the varieties forced.

Bulbs of the hardy narcissi which have not been unduly forced, may be planted outside when the ground is in condition in spring. These bulbs will yield a display of flowers in the garden the second year after forcing, and continue for years if the conditions are right.

The following species and varieties are among the most useful for forcing:

N. Tazetta var. *papyraceus* (paper-white narcissus) is the most useful of the florists' narcissi. Its pure white flowers are of great value to the trade. It is one of the easiest to force and the first to appear on the market.

N. Pseudo-Narcissus var. *Van Sion* (double daffodil) is grown both in boxes for cut-flowers, and in bulb-pans and pots to be used for conservatory and home decoration. Not being adapted to early forcing, the first batch of plants should not be brought into the forcing-house before the end of December or early January.

Narcissus Pseudo-Narcissus var. *obvallaris major* (Tenby daffodil), *N. Pseudo-Narcissus* var. *Golden Spur*, *N. Pseudo-Narcissus* var. *Princeps*, *Emperor*, *Empress*, and *King Alfred*, *N. incomparabilis* var. *Sir Watkin*, *N. Leedsii* var. *Duchess of Westminster*, *N. Barrii* var. *conspicuus*, *N. Jonquilla*, *N. Tazetta*, *N. poeticus* and *N. poeticus* var. *patellaris* are all desirable forms. For very early forcing, *Narcissus Pseudo-Narcissus* var. *obvallaris*, *N. Pseudo-Narcissus* var. *Golden Spur*, and *N. Tazetta* var. *papyraceus* are most



LXX. *Narcissus poeticus*.—The poet's narcissus; hardy and good.

largely grown. Only first-class bulbs should be used for forcing purposes. Bulbs potted early in September will be well rooted by the middle of October, at which time some of the earliest narcissi may be placed in the forcing-house; and by bringing in a batch each week, a continuous display of flowers may be had from November until Easter. For the best results in forcing bulbs, the night temperature should not exceed 60° F.

Growing bulbs in water on pebbles.—Recently much interest has been taken in growing narcissus bulbs in vessels containing water and pebbles. The culture is simple, and such bulbs may be readily grown under dwelling-house conditions. The bulbs should be placed in shallow jardinières or saucers with clean white pebbles arranged around them to keep them in position and to hold them up. The jardinières should be kept supplied with water sufficient to keep the roots submerged. *Narcissus Tazetta* var. *papyraceus* (paper-white narcissus) and *N. Tazetta* var. *orientalis* (Chinese sacred lily) are the most popular and useful for this purpose.

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For other trade names, see supplementary list, at end of article.

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<i>concolor</i> , 4.	<i>monophyllus</i> , 1.	<i>rugulosus</i> , 6.
<i>conspicua</i> , 1.	<i>moschatus</i> , 2.	<i>rupicolus</i> , 7.
<i>Corbularia</i> , 1.	<i>muticus</i> , 2.	<i>spurius</i> , 2.
<i>coreyrensis</i> , 8.	<i>nivalis</i> , 1.	<i>stellaris</i> , 11, 13.
<i>cupularis</i> , 8.	<i>nutans</i> , 4.	<i>Tazetta</i> , 8.
<i>cyclaminicus</i> , 3.	<i>obvallaris</i> , 2.	<i>Telamonius</i> , 2.
<i>dubius</i> , 8.	<i>ochroleucus</i> , 8.	<i>tenuifolia</i> , 1.
<i>fatida</i> , 5.	<i>odoratus</i> , 6.	<i>tenuior</i> , 10.
<i>gaditanus</i> , 7.	<i>orientalis</i> , 8.	<i>triandrus</i> , 4.
<i>Gouani</i> , 5.	<i>ornatus</i> , 13.	<i>trilobus</i> , 4, 6.
<i>gracilis</i> , 10.	<i>pachybulbos</i> , 8.	<i>Trumpet</i> , 2.
<i>Graellsii</i> , 1.	<i>pallidulus</i> , 4.	<i>Webbii</i> , 11.

A. **MAGNICORONATI** or **LARGE-CROWNED species**: *corona* or *crown* as long as the *segms.* or even longer, *trumpet-shaped* or *cylindrical*.—**DAFFODILS**. (*Forms of No. 4 may be sought here.*)

B. *Lvs. green, few (often only 1), very slender and nearly terete, channelled.*

1. **Bulbocodium**, Linn. (*Corbularia* species). **HOOPFETTICOAT DAFFODIL**. A slender small plant, with bulb 1 in. or less in diam., and the very slender lvs. (usually 3 or 4 to each st.) mostly overtopping the blossoms: fl. 1, ascending or horizontal (not declined), $1\frac{1}{2}$ or $1\frac{3}{4}$ in. long in most forms, normally bright yellow in all parts, the very prominent thin flaring *corona* entire or crenulate; perianth-segms. very narrow, ascending, to $\frac{3}{4}$ in. long, the keel green, the same color as crown; stamens inserted near the base of the tube, declined, rather long. S. France to Morocco. May. B.M. 88. J.H. III. 51:393. Gn. 69, p. 222. G. 5:131.—Runs into many garden forms and hybrids. Fls. usually borne 5–8 in. above the ground. Minor forms are var. *conspicua*, a large yellow kind, 6 in.; var. *præcox*, large, yellow, early-flowering, 6 in.; var. *tenuifolia*, small, early-flowering, golden yellow, 3 in.

Var. *Graellsii*, Baker (*N. Graellsii*, Webb). Lvs. about 2; perianth about 1 in. long, whitish or primrose-yellow. Castile. B.M. 6473 B.

Var. *monophyllus*, Baker (*N. monophyllus*, Moore. *N. Clusii*, Dunal. *Corbularia monophylla*, Dur.). Fig. 2437. An Algerian form, winter-blooming, usually with 1 lf., and fl. sessile and white: *corona* crenate. B.M. 5831. Gn. 60, p. 199; 76, p. 94. J.H. III. 42:287.

Var. *citrinus*, Baker. Fls. large, 1–2 in. long, pale lemon-yellow or sulfur-yellow, the *corona* somewhat crenulate and 1 in. diam.; stamens and style included. Gn. 78, p. 189.

Var. *nivalis*, Baker (*N. nivalis*, Graells). Lvs. 2–3, erect and slender, the scape 2–4 in. long; perianth orange-yellow, $\frac{3}{4}$ in. or less long; style and stamens exerted. Spain.

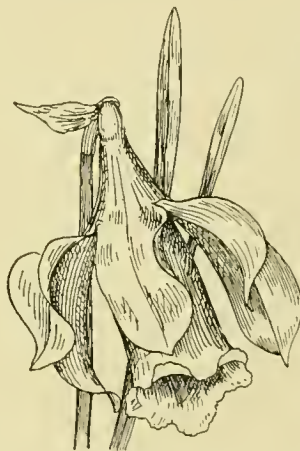
BB. *Lvs. glaucous, several, flat.*

c. *Segms. of perianth spreading horizontally.*

2. **Pseudo-Narcissus**, Linn. (*Ajar Pseudo-Narcissus*, Haw.). **COMMON DAFFODIL**. **TRUMPET DAFFODIL**. **LENT LILY**. Fig. 2438. Strong plant, 12–18 in. tall, with bulb $1\frac{1}{2}$ –2 in. and more diam.: lvs. 4–6, glaucous, narrow but flat, erect, usually about reaching the blossoms: fl. about 2 in. long, horizontal or ascending, pale yellow, the segms. and *corona* usually of different shades, the *corona* deeply crenate or almost crenate-fimbriate, more or less plicate; stamens inserted near the base of the perianth, much shorter than crown; style little longer than stamens. From Sweden and England to Spain and Austria.—Exceedingly variable in size, shape and coloring of fls. There are full double forms (common daffodil) in which the *corona* disappears as a separate body, and supernumerary segms. are present. This is one of the hardiest and commonest of narcissi.

This species is the Trumpet narcissus, so named from the long *corona*. The *Ajar* daffodils are of this species and its derivatives, separated by Salisbury, Haworth and others as a distinct genus (*Ajar*). The normal forms are Yellow Trumpets, but the Bicolor Trumpet, var. *bicolor*, Baker (*N. bicolor*, Linn.), has pure white, spreading and much imbricated segms. and yellow *corona*. To this variety Baker refers *Ajar breviflos*, Haw. (B.M. 1187), and *Horsfieldii*, Burb. Horsfield and Empress are trade forms belonging in this group, the former being the earlier of the two. The White Trumpets are var. *moschatus*, Baker (*N. moschatus*, Linn.; B.M. 1300), which has cream-white or white fls., the perianth-tube obconic and nearly as broad as long, the segms. more or less ascending, twisted, sulfur-tinged and becoming pure white, crown about as long as segms., the throat crenate-plicate and about 1 in. across. Gn. 78, p. 89. J.H. III. 60:443. G. 28:231; 36:192. To this set, Baker refers *N. candidissimus*, Red., *N. longiflorus*, Salisb. (B.M. 924), with twisted segms. shorter than crown; *Ajar albicans*, Haw., with large fl. and more imbricated segms.; *A. cernuus*, Haw., with a more drooping fl. and tube longer than broad, the segms. sometimes longer than crown. The *cernuus* of the trade (Fig. 2439) has segms. equaling and sometimes exceeding the trumpet.

Other main forms or types of *N. Pseudo-Narcissus*



2439. *Cernuus*—a form of *N. Pseudo-Narcissus* var. *moschatus*. ($\times\frac{2}{3}$)

are var. *major*, Baker, to which Baker refers *N. hispanicus*, Gouan, *Ajax propinquus*, Haw., *A. maximus*, Haw., *A. spurius*, Haw., *A. Telamonius*, Haw., *A. loriolius*, Haw., and others. More robust and larger than the type of *N. Pseudo-Narcissus*, the fls.



2440. *Narcissus maximus*.—A form of *N. Pseudo-Narcissus*. ($\times \frac{2}{3}$)

(Fig. 2440) has a very large fl., deep golden yellow, segms. twisted at ends, crown with spreading limb. G. 6:505; 25:132 (as *maximus superbus*); 28:145. J.H. 111. 43:274. *Obevallaris*, Hort. (Tenby daffodil) is a sub-variety of var. *major*. It is a distinct form of medium size, somewhat dwarf, very floriferous, almost self-yellow, the perianth wheel-like with rather short segms. Gn. 63, p. 245. Var. *minor*, Baker (*N. minor*, Linn. *Ajax minimus*, Haw.), is much smaller in all its parts than the type of *N. Pseudo-Narcissus*; lvs. 3-4 in. long and $\frac{1}{4}$ in. broad: fls. to $1\frac{1}{4}$ in. long, with obconic tube and oblong sulfur-yellow segms.; crown deeper yellow, with deeply 6-lobed spreading throat. The garden *minimus* (Fig. 2441) is very small in all ways; said to be the smallest and earliest Trumpet narcissus. Gn. 76, p. 563. G. 36:171. Var. *mūticus*, Baker (*Ajax mūticus*, Gay). General stature of *N. Pseudo-Narcissus*, with somewhat broader lvs.: fl. to $1\frac{1}{2}$ in. long, with obconic tube and sulfur-yellow segms.; crown deep lemon-yellow, as long as



2441. *Narcissus minimus*.—A form of *N. Pseudo-Narcissus*. ($\times \frac{2}{3}$)

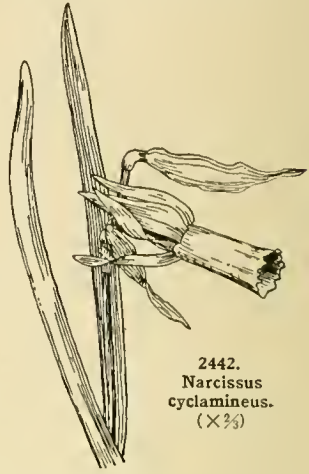
segms., $\frac{3}{4}$ in. diam., the throat very truncate: from the Pyrenees. Gn.W. 5:593. Var. *Johnstonii*, Baker (*N. Johnstonii*, Hort.), is described by Baker as "a Portuguese form with a tube $\frac{3}{4}$ in. long, $\frac{1}{2}$ in. broad at the throat, a pale truncate corona, and style much longer than the stamens." Bourne calls *N. Johnstonii* "a typical hybrid. Found wild in Portugal (*Pseudo-Narcissus* $\times$ *triandrus*). Slightly variable in form. In color from soft sulfur to pale lemon. Long straight, funnel-shaped corona; perianth-segms. somewhat reflexed. Is best grown in grass or coldframes."

According to Bourne, "the

recognized type fl. of *N. Pseudo-Narcissus* is the wild daffodil of England. Trumpet yellow; perianth-segms. pale sulphur." White varieties are found wild here and there in England. There are many hybrids and intermediate forms with Latin names. See supplementary list, page 2113.

cc. Segms. reflexed or pointing backward.

3. *cyclamīneus*, Baker (*Ajax cyclamīneus*, Haw. *N. Pseudo-Narcissus* var. *cyclamīneus* Baker). Fig. 2442. Lvs. narrow and linear, deeply grooved, the scape slender and subterete: fl. very drooping, the tube obconic and very short, the segms. lemon-yellow, $\frac{1}{4}$ in. broad, abruptly reflexed (hence *cyclamīneus*, or cyclamen-like); crown equaling the segms., orange-yellow, crenate. Portugal. B. M. 6950. Gn. 59, p. 352; 69, p. 148; 71, p. 252. J.H. 111. 42:287; 64:305.



2442. *Narcissus cyclamineus*. ($\times \frac{2}{3}$)

AA. *MEDIOCORONATI* or *MEDIUM-CROWNED species*: corona or crown usually about half the length of the segms., cup-shaped. (Forms of *N. triandrus* may have large crowns.)

B. Segms. narrow, standing straight backwards (reflexed).

4. *triandrus*, Linn. (*Ganymēdes albus*, Haw.). Fig. 2443. Slender most dwarf rush-lvd. species (scape 10-15 in. tall), bulb $\frac{3}{4}$ in. or less diam.: lvs. few (2-4), very slender and semi-cylindrical and not overtopping the blossoms, channeled: scape very slender, semi-cylindrical: fls. 1 to several, horizontal or drooping, an inch long, but variable in size, both the lanceolate sharply-reflexed segms. and the entire cup-shaped corona (which is half as long as segms.) pure white in the type; stamens sometimes a little exerted. Spain and Portugal. G. 17: 114; 19:355.—There are several forms, as var. *cōncolor*, Hort. (*Ganymēdes cōncolor*, Haw.), pale self-yellow; var. *pallidulus*, Hort. (*N. pallidulus*, Graells), primrose-yellow. B.M. 6473 A; var. *pulchellus*, Hort. (*Ganymēdes pulchellus*, Haw.), segms. yellow, corona white. B.M. 1262. (as var. *luteus*). Gn. 75, p. 604; var. *nūtans*, Hort. (*Ganymēdes nūtans*, Haw. *N. trilobus*, B.M. 945), corona a deeper yellow than the segms., crenulate.

Var. *calathinus*, Hort. (*N. calathinus*, Red., Burbidge, not Ker). Crown or corona larger, nearly, or quite as long as the segms., the fl. pale yellow. Isl. of Brittany. Gn. W. 20:297. Gn. 77, p. 459.

nn. Segms. oblong or broader, spreading.

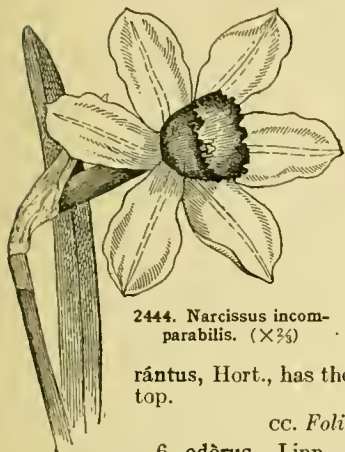
c. Foliage glaucous,

5. *incomparābilis*, Mill. (*N. Gouani*, Red. *Quēllia fātida*, Herb.). Fig. 2444. Strong fine ornamental plant, with large bulb ($1\frac{1}{2}$ in. diam.) and 3-5 lvs.: lvs. flat (but narrow) and glaucous, nearly or quite the length (1 ft. or more long) of the distinctly 2-edged scape: fl. always 1, not fragrant, horizontal or



2443. *Narcissus triandrus*. ($\times \frac{2}{3}$)

somewhat ascending, on a very short pedicel, the tube usually greenish, and subcylindrical, the segms. and crenate-plicate 6-lobed corona pale yellow in the type (but varying to other color combinations), the stamens



2444. *Narcissus incomparabilis*. ($\times \frac{3}{4}$)

and style not exerted. S. France and Spain to the Tyrol; by some considered a hybrid race of *N. Pseudo-Narcissus* $\times$ *N. poeticus*. B.M. 121. G. 4:127.—One of the commonest species in cult., the fls. often 3–4 in. across, and in many varieties. Double forms are frequent. Var. *álbus*, Hort., has white fls., with the corona usually pale yellowish. Var. *aurántus*, Hort., has the corona orange at the top.

cc. *Foliage green*.

6. *odórus*, Linn. (*N. calathinus*, Ker. *Philóggyne odóra*, Haw. *N. Campernéllii*, Hort.). CAMPERNELLE JONQUIL. Lvs. half the width ($\frac{1}{4}$ in.) of those of *N. incomparabilis*, the bulb nearly or quite as large, the peduncle subterete; fls. about 2 (sometimes 4), fragrant, the tube more slender than in *N. incomparabilis*, and the obconic shortly 6-lobed crenate corona somewhat smaller, the fl. bright yellow throughout; segms. obovate-oblong, cuneate below, spreading and not imbricated, to $1\frac{1}{4}$ in. long; style exceeding the anthers and reaching about half way of the crown. France and Spain and eastward; although found wild, by some regarded as a hybrid of *N. Jonquilla* $\times$ *N. Pseudo-Narcissus*. B.M. 934.—A good hardy species, differing from *N. incomparabilis* chiefly in its narrow lvs., 2 or more blossoms to a peduncle, fls. fragrant. Var. *trilobus*, Baker (*N. trilobus*, Linn., *N. látus*, Salisb. *N. odórus* var. *látus*, Hort. *Philóggyne hcmínális*, Haw.). Fls. smaller, the segms. about $\frac{3}{4}$ in. long and imbricated; crown lobed, much shorter than segms. B.M. 78. Var. *minor*, Burb., fls. 1 in. diam. and the crown very small. Var. *rugulósus*, Hort. (*Philóggyne rugulósus*, Burb.), has shorter oblong imbricated perianth-segms. Queen Anne's Jonquils are double forms of *N. odórus*.

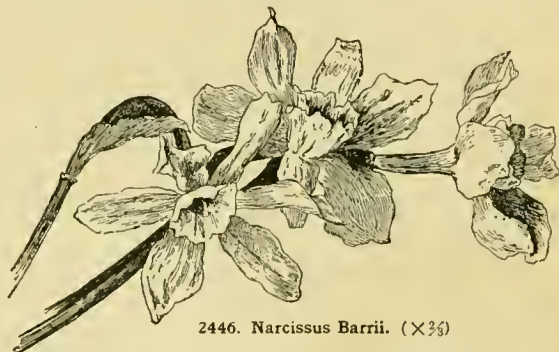
7. *juncifólius*, Lag. (*N. Requiéni*, Roem. *Quéltia juncifólia*, Herb. *Philóggyne minor*, Haw.). Very small



2445. *Narcissus rupicolus*.—A form of *N. juncifolius*. ($\times \frac{3}{4}$)

slenderspecies, with bulb about $\frac{1}{2}$ in. diam., and very narrow rush-like terete lvs., about 6 in. long; scape slender and terete, 6–12 in. long; fls. 1–4, horizontal or ascending, the tube slender-cylindrical ($\frac{1}{2}$ in. long), the ovate spreading imbricated segms. and the cup-shaped, crenulate corona bright yellow or the corona sometimes darker; style reaching the throat of the tube; segms. about twice as long as corona. S. France and south.—A choice fancier's plant. Var. *minutiflórus*, Baker (*N. minutiflórus*, Willk.), has about 4 very small

fls., the perianth-tube $\frac{1}{3}$ in. and the ovate segms. $\frac{1}{6}$ in. long; corona truncate. Var. *rupicolus*, Baker (*N. rupicolus*, Dufour), Fig. 2445, has pedicels none or very short, perianth-tube $\frac{3}{4}$ in. long and limb $\frac{3}{4}$ in. across; corona 6-lobed. B.M. 6473 C. Var. *gaditánus*,



2446. *Narcissus Barrii*. ($\times \frac{3}{4}$)

Baker (*N. gaditánus*, Boiss.). Fls. 4 or 5, with rather long pedicels; segms. of perianth $\frac{1}{6}$ in. or less long, broadly ovate; corona truncate, nearly equaling segms.

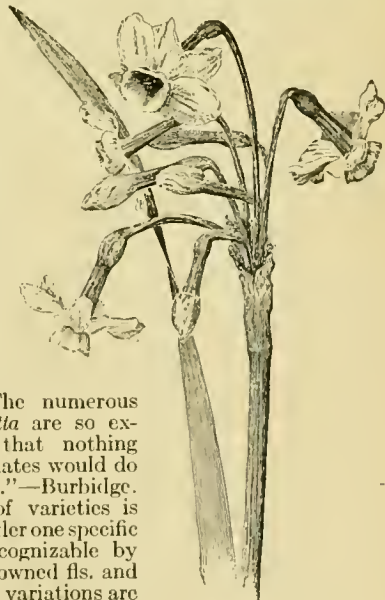
In this medium-crowned section belong many hybrid races derived from the long-crowns (or trumpets) and the short-crowns. Perhaps the best-known of these races in gardens are those called *N. Barrii* (Fig. 2446) and *N. Leedsii* (see pp. 2106 and 2113).

AAA. *PARVICORONATI* or *SMALL-CROWNED species*: corona usually much less than half the length of the segms., mostly saucer-shaped.

B. *Corona soft and uniform in texture*: lvs. various.

C. *Lvs. $\frac{1}{2}$ in. or more broad, flat, mostly somewhat glaucous*.

8. *Tazétta*, Linn. *POLYANTHUS NARCISSUS*. Fig. 2447. Strong variable species, the bulb often 2 in. diam., the 4–6 lvs. $1\frac{1}{2}$ ft. or less long, about the length of the flattened peduncle; fls. several (4–8 or 12), horizontal or declined on slender pedicels, the tube less than 1 in. long and greenish, the spreading obovate imbricate segms. pure white, and entire cup-shaped corona lemon-yellow, the whole fl. about $1\frac{1}{2}$ in. across; stamens and style barely exerted. Canary Isls. to China and Japan.—Perhaps the commonest species and very variable. "Of the multiform *Tazetta* narcissi about 100 have received specific names."—Baker. In his monograph, he describes 14 subspecies, named in italics below. "The numerous forms of *N. Tazetta* are so extremely variable that nothing short of 50 folio plates would do the plant justice."—Burbidge. All this wealth of varieties is readily grouped under one specific type, which is recognizable by the many small-crowned fls. and the broad lvs. The variations are largely in color and in size of fls. Baker makes three groups:



2447. *Polyanthus narcissus*.—*N. Tazetta*. ($\times \frac{1}{3}$)

(a) *bicolores*, the perianth white and the corona yellow. Here are to be placed *lacticolor*, *corycensis*, *patulus*, *ochroleucus* and many others.

(b) *alba*, entire fl. white. Here belongs the "Paper White" (var. *papyraceus*, Hort. *N. papyraceus*, Ker. B.M. 947) very popular for winter bloom. G. 26:137.

Here are to be referred the names *Panizzianus*, *dubius*, *canariensis*, *pachybolbos*, *polyanthos*.

(c) *lutea*, entire fl. yellow. Here belong *aureus*, *cupularis*, *Bertolonii*, *italicus*.

Var. *orientalis*, Hort. (*N. orientalis*, Linn. *Queltia orientalis*, Salisb.). CHINESE SACRED LILY. Consid-

ered by Baker and others to be probably a hybrid between *N. incomparabilis* and *N. Tazetta*: robust: lvs. flat and green, $\frac{1}{2}$ in. broad: scape much compressed: fls. 3-4, on long erect or curving pedicels: tube of perianth subcylindrical, $\frac{1}{2}$ in. long and green, the segms. oblong, acute, sulfur-yellow, 1 in. long and half as wide; corona cup-shaped, one-third length of segms., orange-yellow, irregularly

3-lobed with erect margin; stamens and style not exerted. B.M. 948.—Grown in bowls of water; very fragrant.

N. poetaz, Hort., is a hybrid race, from *N. Tazetta* $\times$ a form (*ornatus*) of *N. poeticus*. It is a promising race, with several poeticus-like fls. on the scape, the fragrance less cloying than that of *N. Tazetta*. They force readily. Writing of the origin and characteristics of the poetaz section, Joseph Jacob says in The Garden that they originated in 1885 in the bulb-fields of R. van der Schoot & Son, at Hillegom, Holland, from *N. ornatus* used as seed parent crossed with different kinds of *N. Tazetta*. "In their general appearance, this new race partakes of the characters of both parents. The Poet shows itself in the larger fls. and in some of the cups, while the Tazetta appears in their having several fls. upon one st. To sum up, they may be described as a large-fl. Polyanthus narcissus having from 2-6 blooms on a st., more pleasantly scented, and, generally speaking, with a looser and more artistic perianth." The *Poetico-Tazetta* narcissi are of this group or race.

cc. Lvs. $\frac{1}{4}$ in. or less broad, mostly terete or subterete, not glaucous.

9. *intermedius*, Lois. A yellow-fl. species, thought by some to be a hybrid between *N. Tazetta* and *N. Jonquilla*, distinguished from *N. Tazetta* chiefly by its subterete deep-channelled green lvs., which are only $\frac{1}{4}$ in. wide: scape nearly terete: fls. 4-10; crown one-fourth or less the length of the oblong slightly imbricated spreading perianth-segms.; fls. soft yellow, the segms. described as lemon-yellow and the corona as orange-yellow: except for the subcylindrical green lvs. it might be taken for a form of the yellow race of *Tazettas*. S. France and Spain. Var. *primulinus*, Hort.

(*Hermione primulina*, Haw.), has imbricated segms. and the corona or crown with a 6-lobed spreading margin. B.M. 1299. Var. *bifrons*, Hort., has narrow perianth-segms. and deep crown.

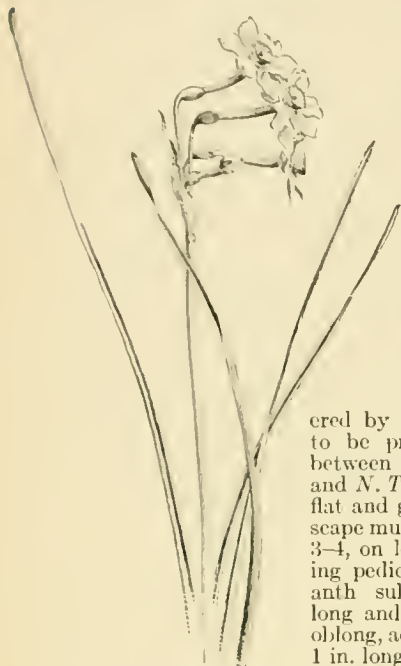
10. *gracilis*, Sabine. Smaller, rush-lvd., 1 ft. high, the scape slender and weak and subterete, 1 ft. long: lvs. bright green, $\frac{1}{2}$ in. or less wide and very convex on the back: fl. pale yellow, the corona usually somewhat deeper colored than the oblong acute imbricated segms.; stamens and style not exerted. S. France probably, but known chiefly as an old garden plant, and perhaps, a hybrid of *N. Jonquilla* $\times$ *N. Tazetta* or *N. juncifolius* $\times$ *N. Tazetta*. B.R. 816. Var. *tenuior*, Hort. (*N. tenuior*, Curt.), the "silver jonquil," is more slender in all parts, the paler fls. changing to white. B.M. 379.

11. *Jonquilla*, Linn. JONQUIL. Fig. 2448. Very slender and graceful hardy plant, $1\frac{1}{2}$ ft. or less tall, the lvs. and subterete scape about equal in height: lvs. glossy dark green and very narrow and rush-like, 2-4 to a st.: fls. 2-6, fragrant, the slender cylindrical tube greenish yellow and 1 in. or less long; segms. yellow, obovate and scarcely overlapping; corona very short ($\frac{1}{2}$ in. or less long), crenate, cup-shaped, the same color as the segms.; stamens and style barely exerted. S. Eu. and Algeria. B.M. 15.—One of the old-fashioned fls., perfectly hardy in N. Y. There is a double-fl. form. Var. *minor*, Baker (*N. Webbii*, Parl. *Jonquilla minor*, Haw.), is a dwarf form: lvs. very slender: perianth-limb $\frac{1}{2}$ in. diam. Var. *stellaris*, Baker. Segms. lanceolate, reflexing; crown 6-lobed. Var. *jonquilloides*, Baker (*N. jonquilloides*, Willk.). Tube of perianth $\frac{1}{2}$ in. long, the limb $\frac{3}{4}$ in. diam., the segms. obovate and imbricated; crown more than half as long as segms., the throat plain.

bb. Corona with a prominently hardened or dry rim: lvs. broad.

12. *biflorus*, Curt. PRIMROSE PEERLESS. Strong fragrant-fl. species, with globose bulb 2 in. or less in diam.: lvs. about 4 to a st., 1-2 ft. long and nearly or quite $\frac{1}{2}$ in. broad, and slightly glaucous, channeled, usually equaling and sometimes exceeding the stout 2-edged scape or peduncle: fls. 1-3, usually 2, white, with a pale yellow cup, the tube greenish white and 1 in. long, the segms. milky white, broad-obovate and overlapping; the corona pale yellow, $\frac{1}{2}$ in. long, with a crisped scarious erect edge; stamens and style barely exerted. S. Eu. B.M. 197. G. 13:55; 27:295.—This plant has a wide range in the wild state, but some persons regard it as a hybrid of *N. Tazetta* and *N. poeticus*. Apparently little known in this country. Var. *albus*, Hort., has white fls.

13. *poeticus*, Linn. POET'S NARCISSUS. PHEASANT'S EYE. Fig. 2449. A beautiful and popular strong-growing and hardy species, $1\frac{1}{2}$ ft. high, the bulb 1 in. or more thick: scape or peduncle as long as the lvs., 2-



2448. Jonquil.—Narcissus Jonquilla. ($\times \frac{1}{2}$)



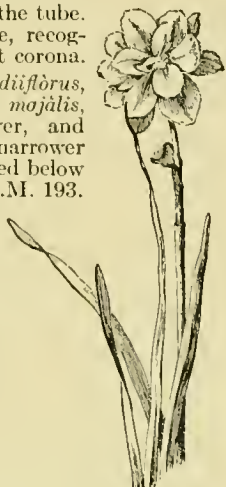
2449. Narcissus poeticus. ($\times \frac{1}{4}$)

edged; lvs. about 4 to a st., linear, $\frac{1}{2}$ in. broad, somewhat glaucous; fls. solitary (rarely 2), fragrant, horizontal, wide open, the obovate overlapping segms. white, about 1 in. long in native plants; corona much crisped and red-edged, $\frac{1}{2}$ in. or less long; tube of perianth cylindrical, greenish, 1 in. long; stamens and style barely exerted from the tube. Medit. region.—An old favorite, recognized by the red-margined short corona.

Var. *radiiflorus*, Burb. (*N. radiiflorus*, Salisb. *N. angustifolius* and *N. majalis*, Curt.). Slender; lvs. narrower, and shorter than the scape: corona narrower and more erect; segms. narrowed below so that they do not overlap. B.M. 193. An early-fl. form, often known as var. *angustifolius*. Var. *ornatus*, Hort. (*N. ornatus*, Haw.) is an early-flowering kind, distinct in its perfect form: segms. of good substance, imbricated, broad and rounded. Var. *poetarum*, Hort. (*N. poetarum*, Haw.), blooms after var. *ornatus*: fls. large; segms. imbricated and slightly recurved; corona red or reddish to base.

Horticultural forms of *N. poeticus* are: *plenus* (Fig. 2450), double, late-fl.; *recurvus*, lvs. much recurved, and segms. recurving; *patellaris*, fls. flat, crown large, segms. much imbricated; *stellaris*, has a much distended bladder-like spathe. For poeticus forms, see Pugsley, Journ. Bot., Aug., 1915.

N. abscessus, Schult.—*N. Pseudo-Narcissus* var. *muticus*.—*Ajax* is an old generic name for *N. Pseudo-Narcissus*; this species is now sometimes called the *Ajax narcissus*.—*N. Bäckhousei*, Hort. (*N. Pseudo-Narcissus* $\times$ *incomparabilis*; or *N. Pseudo-Narcissus* $\times$ *Tazetta*, or *N. bicolor* $\times$ *poeticus*) has single horizontal sulfur-yellow fls. with tube about half equaling the segms., the latter about 1-1 $\frac{1}{2}$ in. long; crown lemon-yellow, nearly equaling segms., erect, deeply lobed and plicate. —*N. Barrii*, Hort. (*N. poeticus* $\times$ *Pseudo-Narcissus* or *N. incomparabilis* $\times$ *poeticus*), of the medium-crowned section, has yellow horizontal fls. with long, slender neck; "covers a series of forms intermediate between *incomparabilis* and *poeticus*, nearer the former than the latter" (Baker); Fig. 2446. G.M. 51:644. Gn. 73, p. 599; 78, p. 458 (all as *N. Barrii* conspicuous). A popular form (see p. 2106). —*N. Bernardii*, Hcn., is like *N. Macleanii*, but with a more plicate and deeper-colored corona, which is orange or lemon-yellow, and half as long as the spreading white segms. Pyrenees, said to occur where *N. Pseudo-Narcissus* var. *muticus* and *N. poeticus* grow together. —*Bunch-flowered daffodils* are *N. Tazetta*. —*N. Broussonetii*, Lag. Lvs. linear, about 4 to a st.; scape 1 ft., 2-edged; fls. many in an umbel, the cylindrical tube whitish, the oblong obtuse segms. $\frac{1}{2}$ in. long and pure white; crown rudimentary; anthers exerted. Morocco. —*N. Biribidgei*, Hort. (probably *N. incomparabilis* $\times$ *poeticus*, in a series of forms). Short-crowned; it has the habit of *N. poeticus*, with a solitary drooping fl. with white horizontal or somewhat reflexed segms. and a very short corona with a yellow base and red rim. —*Cambricus* is an early bicolor form of *N. Pseudo-Narcissus*; segms. sulfur-white; crown or trumpet yellow. —*Capax plenus* is an old double form, lemon-yellow. —*N. Cooksoniae*, Hort., is a creamy-white variety of the Leedsii type. G.C. III. 47:336. —*Corbularia narcissi* are the *N. Bulbocodium* forms. *Corbularia* is an old generic name for this species. —*Daffodil*. The word daffodil is variously used. In this country it means usually the full double forms of *N. Pseudo-Narcissus*, plants that are very common in old gardens. Modern named varieties of this daffodil type are Van Sion and Rip Van Winkle. In England, however, daffodil is a more general term, used for most species except the Poet's narcissus (*N. poeticus*). —*N. elegans*, Spach (*N. autumnalis*, Link). Autumn-flowering; bulb globose, $\frac{1}{2}$ in. diam.; lvs. 1-4, appearing with the fls., very narrow, subterete; scape stiff and erect; fls. 2-6, on erect pedicels; perianth-tube cylindrical, whitish, about $\frac{1}{2}$ in. long; segms. spreading, lanceolate, pure white; crown very short, saucer-like, yellow. Italy, Algeria. —*N. Engleheartii*, Hort. Hybrids of *N. incomparabilis* and *N. poeticus*, the name of recent origin: much like *N. Burbridgei* but the flat crown or cup is ruffled or fluted. This comprises the relatively new section of "flat-eyes" or "flat-crowns," although the cup may take the form of a shallow wide-mouthed funnel. —*N. Fésteri*, Lynch. Garden hybrid between *N. Bulbocodium* var. *citrinus* and *N. triandrus*, the latter probably the male parent; scapes 2-fld.; fls. have the *Bulbocodium* character in size and shape of perianth, lanceolate segms. and declinate stamens; lvs. much like those of *N. triandrus*; crown and segms. pale yellow, tube greenish. G.C. III. 47:342. —*Flat-leaved narcissi* are the various forms of *N. Pseudo-Narcissus*. —*Ginnymedes* is an old generic name for *N. triandrus* and its forms. —*Giganteus* = *Sir Watkin*. —*Grandiflorus* is



2450. *Narcissus poeticus* var. *plenus*. ($\times \frac{1}{2}$)

applied to a large-fl. white form of *N. Tazetta*. —*N. Humei*, Hort., has a single nodding medium-crowned yellow fl. with long, straight cup about 1 in. long (often equaling the segms., but variable in size); segms. oblong, somewhat ascending, $1\frac{1}{2}$ in. long; fls. said to have "a deformed clift-off appearance." Ascribed to *N. Pseudo-Narcissus* and *N. poculiformis*. —*Incognita*, one of the Engleheartii forms, or by some referred to *N. Barrii*. Gn. 71, p. vii, Nov. 30 (1907); 73, p. 301. G.M. 54:300. —*N. Leedsii*, Hort., has horizontal or drooping fls. with white segms. and yellow to whitish medium corona; described by Baker as having perianth-tube subcylindrical, $\frac{3}{4}$ in. long; segms. spreading, oblong, acute, milk-white, to $1\frac{1}{4}$ in. long and to $\frac{3}{4}$ in. broad; crown cup-shaped, $\frac{1}{2}$ in. long, sulfur-yellow, erect and irregularly crenate-plicate; style overtopping anthers and reaching nearly to throat of crown; intermediate between *N. poculiformis* and *incomparabilis*, but said by some to be produced by crossing white *N. Pseudo-Narcissus* varieties with *N. poeticus*. (See p. 2106). —*Lent Lily* = *N. Pseudo-Narcissus*. —*Lobularia* is a confused name, usually applied to the deep yellow double daffodil, *N. Pseudo-Narcissus*. —*Lusitanicus* is a name for a bicolor *N. Pseudo-Narcissus*. —*N. Macleanii*, Lindl., is a 1-fl. plant of small growth, bearing horizontal short-tubed fls. with milk-white segms. and medium-sized yellow crenate corona half or more the length of the lobes; segms. much imbricated, about $\frac{3}{4}$ in. long, crown about $\frac{1}{2}$ in. long, minutely crenulate; style included. Of doubtful origin, several species having been suggested as parents. B.M. 2588. B.R. 987. Gn. 69, p. 103. —*N. Mastersianus* is a hybrid of *N. Tazetta* and *N. poculiformis*. —*N. Milneri*, hybrid of *N. incomparabilis* and *N. Pseudo-Narcissus* var. *moschatus*. —*N. minicajda*, Hort. A garden hybrid between *N. cyclamineus* and *N. minimus*. —*N. montanus*, Ker = *N. poculiformis*. —*N. Nelsonii*, Hort., a subtype of *N. Macleanii*, very robust, and fls. larger (2-3 in. across), the lemon-yellow corona more than half as long as the segms. —*N. pallidus*, a whitish form of *N. Pseudo-Narcissus*. —*Pallidus praecox* is a pale sulfur-colored early form. Gn. 60, p. 320; 65, p. 271. G. 30:215. —*Peerless narcissi* are the forms of *N. incomparabilis*. —*N. poculiformis*, Salisb. (*N. montanus*, Ker; B.R. 123) has 1 or 2 nodding medium-crowned white fls. and a cup-shaped corona about half the length of the segms.; origin doubtful: by some regarded as a hybrid and by others as a native of the Pyrenees. —*Priniceps*, sulfur-yellow and yellow-crowned, a form of the *N. Pseudo-Narcissus* type. G.C. III. 29:182. —*Queltia* is an old generic name to distinguish the group comprising *N. incomparabilis*. —*Rip Van Winkle* is a double variety of *N. Pseudo-Narcissus*. —*Roman narcissus* is a name for double-fl. *N. Tazetta*, white with orange cup. —*Rugilobus*, large-fl. variety of *N. Pseudo-Narcissus*, with primrose perianth and yellow trumpet. G. 16:89. —*Salmonetta*, raised by Engleheart: perianth clear white; cup salmon-orange; fl. star-like. Gn. 63, p. 393. —*Seolcius*, *N. Pseudo-Narcissus* with deep yellow corona and whitish segms.; known as Scotch garland lily. There is also a double form. —*N. serotinus*, Linn. Autumnal: bulb globose, 1 in. or less in diam.; lvs. appearing after the fls.; very slender; scape very slender and jointed low down; fls. 1 or 2; tube subcylindrical, greenish; segms. oblanceolate, obtuse, spreading, pure white, about $\frac{1}{2}$ in. long; crown very short, 6-lobed, lemon-yellow. Medit. region. —*Sir Watkin* or *giganteus* is a very large-fl. form of *N. incomparabilis*. —*N. Sprangeri vomerensis* is a garden hybrid between *N. Pseudo-Narcissus* and *N. Tazetta*. A subform of var. *major*. —*Stella*, one of the star-narcissi of the *N. incomparabilis* group; now represented by *Stella Superba*, about twice the size, with long white spreading segms. and cup clear yellow. J.H. III. 43:269. —*Telamonius plenus* is the common sulfur-yellow double daffodil, *N. Pseudo-Narcissus*. Gn. 73, p. 227. —*Tortuosus* has twisted segms.; a form of *N. Pseudo-Narcissus*. —*Tridymus* is like *N. Nelsonii*, but has 2-3 smaller fls., with tube usually obconic (*N. Pseudo-Narcissus* $\times$ *Tazetta*). —*Van Sion* is a large pure yellow and very double form of *N. Pseudo-Narcissus* of the *Telamonius* set; much used for forcing. There is also a single *Van Sion*. —*Variiformis* is a form of *N. Pseudo-Narcissus* with canary-yellow corona and white segms., the fls. variable. —*N. viridiflorus*, Schoub. Autumnal: bulb globose, 1 in. diam.; lvs. 1 or 2 to st., subterete, not appearing with the bloom; fls. 2-4, on a slender fragile scape, green in all parts; perianth-tube cylindrical and slender, about $\frac{1}{2}$ in. long; segms. lanceolate, reflexing, short; crown very short, 6-lobed; anthers barely exerted. Gibraltar, Morocco; very late. B.M. 1687. G.C. III. 40:375.

L. H. B.

NARTHECIUM (the name may be derived from *Narther*, the Greek name of *Ferula*, the stems of which were used as rods; or by others explained as an anagram of *Anthericum*). *Liliaceae*. BOG-ASPHODEL. Perennial rhizomatous herbs.

Flowers yellowish green, the solitary pedicels subtended by a narrow bract, and bearing a small linear bractlet; perianth-segms. linear-lanceolate, obscurely 3-nerved, reflexed or spreading in fl., soon erect, persistent; stamens 6, included; filaments subulate, woolly; anthers linear-oblong; style none; the slightly lobed stigma sessile upon the attenuated apex of the ovary: caps. narrowly oblong, membranous, prolonged upward, splitting into 3 valves; seeds long with a straight tail at each end; lvs. 3-8 in. long, often less than $\frac{1}{2}$ in. broad; grass-like and vertical: sts. 1-2 ft. tall.—About 6 species, natives of northern hemisphere, Eu., E. Asia, Atlantic states, Calif.

The genus is close to *Tofieldia* in having a persistent perianth, simple racemes, and grass-like lvs.; resembles *Simethis* in the bearded filaments and simple style. The perianth is firmer than in most liliaceous plants and shows an approach to Juncaceæ, with which many botanists associate it. Some botanists call this genus *Abama* and assign it to the family Melanthaceæ.

californicum, Baker. Lvs. iris-like; basal ones $\frac{1}{8}$ – $\frac{1}{6}$ in. broad; cauline lvs. 2–3 in number, short; raceme 3–5 in. long, loose; sts. 18–20 in. high; fls. 30–40, yellowish green; caps. of paper-like texture, slender at top, 3-valved, when ripe a bright salmon-color; seeds, including the points or tails, $\frac{1}{2}$ in. long. Swamps, Calif.—Intro. by dealers in native plants in 1888 or 1889.

M. B. COULSTON.

A. C. HOTTES,†

NASEBERRY: *Sapodilla*.

NASTÛRTIUM (classical Latin name of some cress, referring to its pungent smell: *nasus*, nose, and *tortus*, distortion). *Cruciferae*. The name *Nasturtium* is used for two very different groups of plants. As a flower-garden name, it is used for plants of the Tropæolaceæ (see *Tropæolum*). It has also been used for certain crucifers, including the water-cress and horse-radish; but as a generic name it is now replaced, mostly by *Radicula*, which see.

NATAL PLUM, a handsome shrub (*Carissa grandiflora*, of the family *Apocynaceæ*), originally from South Africa, is cultivated in southern Florida and southern California for ornament and for its scarlet edible fruits the size of a plum. Fig. 2451. It is considered one of the best hedge plants in South Africa, and is some-

times used for this purpose in the United States. See *Carissa*.

The Natal plum is a large shrub, eventually attaining to 15 or 18 ft., much branched and spreading, and armed with stout bifurcate spines; foliage dense, glossy green in color; lvs. opposite, ovate-acute, mucronate, thick and leathery, 1–2 in. long; fls. star-shaped, fragrant, about 2 in. across and borne in small terminal cymes; calyx composed of 5 oblong-acute lobes about $\frac{1}{8}$ in. long; corolla salverform, with a slender tube about $\frac{3}{4}$ in. long and 5 oblong-obovate lobes twice the length of the tube and twisted to the left in bud; stamens 5, in-

serted upon the tube; style clavate; ovary superior, 2-celled, with several ovules in each cell.

The plant blooms most abundantly in early spring, but produces a few scattering flowers throughout the year; their waxy texture and fragrance are suggestive of the jasmine. The fruits, most of which ripen in

summer, are ovoid or elliptic in form, commonly 1 to 2 inches long, with a thin skin inclosing the firm granular reddish pulp toward the center of which are several thin papery almost circular seeds,—sometimes as many as twenty or more. The fruit is very attractive in appearance, but is not generally relished when eaten out of hand; its flavor suggests the raspberry or cranberry, and when stewed it yields a sauce which greatly resembles that made from the latter fruit. It is also used for jelly and preserves. It is not of commercial importance in the United States, but is frequently planted in gardens for ornament and fruit. It seems well adapted to cultivation in both Florida and California, withstanding several degrees of frost without injury, and being somewhat drought-resistant. Among seedlings, however, there is great variation in productiveness, so that vegetative means of propagation must be used to perpetuate good varieties. Firminger states that grafting on *Carissa Carandas* renders the species more productive.

When used as a hedge-plant it withstands shearing admirably, but yields little fruit under these conditions. Its growth is compact and low, and it has the interesting habit of branching dichotomously. It succeeds on a variety of soils, from the lightest sand to heavy clay or adobe, and when left to itself will form a shapely attractive bush.

Seeds are easily germinated by planting in pans of light sandy loam. They should be as fresh as possible and barely covered with soil. Cuttings, when planted directly after removal from the parent bush, do not root very readily, but a method has been discovered by Simmonds whereby nearly every one will grow: this consists in notching young branchlets while still attached to the plant, making a cut half way through the stem 3 or 4 inches from the tip; the branchlet is then bent downward and allowed to hang limply until the end of the second month, when a callus will have formed on the cut portion, and the cutting may be removed and placed in sand under a lath shade, requiring another month to strike roots. The plant is also easily propagated by layering, and it is not difficult to bud, using the common method of shield-budding, essentially the same as practised with the avocado. Late spring is the best time to do the work.

Another species of *Carissa* in cultivation and which is sometimes confused with *C. grandiflora* is *C. bispinosa* (*C. arduina*). This can be distinguished from *C. grandiflora* by the much smaller size of the flowers, which are only $\frac{1}{2}$ inch broad, with the corolla-segments much shorter than the tube, and by the oblong-obtuse fruit which is only $\frac{1}{2}$ inch in length and contains one or two instead of many seeds lanceolate in outline.

Carissa Carandas, a species common in India, where it is known as karaunda, has also been introduced to this country. It is distinguished from the above two by the corolla-lobes being contorted to the right instead of to the left (as stated on page 664), by the oblong or elliptic-oblong leaves with rounded or obtuse tips, and by the spines being simple in place of bifurcate. Its fruits are $\frac{1}{2}$ to 1 inch long, containing three or four seeds, and are much used in India for pickles and preserves.

F. W. POPENOE.

NATHÛSIA (Gottlob Nathusius, 1760–1838, Prussian plantsman). *Oleaceæ*. Four trees of India and tropical Africa seldom cult., for which see *Schrebera*.

NATIVE PLANTS. The desire for native and natural plants is one of the dominant notes of the present time. It is not strange that wild plants are not appreciated in a new country. The first necessity of civilization is to fell the trees that ground may be tilled and habitations be built. The necessities of life are imported; the literature is exotic; the plants are transported from other lands. In Europe the condi-



2451. Natal plum.—*Carissa grandiflora*.
($\times \frac{1}{2}$)

tions of living had become established. People had outgrown the desire to remove. They appreciated their own plants and also those from the New World. American plants attracted attention in Europe rather than in America.

Twenty-five years ago, the writer made a census of indigenous American plants known to have been introduced to cultivation. The statistics were published in "Annals of Horticulture for 1891." It was found "that there are in North America, north of Mexico, about 10,150 known species of native plants, distributed in 1,555 genera and 168 families. Of these, 2,416 species are recorded in this census, representing 769 genera and 133 families. Of this number, 1,929 species are now offered for sale in America; 1,500 have been introduced into England, of which 487 are not in cultivation in this country." All these species are there catalogued. The only other account of the entire cultivated flora is that which was compiled in the "Cyclopedia of American Horticulture," 1900-1902, and for which the lists of twenty-five years ago were a preparation. That Cyclopedia described 2,419 species of plants native to North America north of Mexico. A brief sketch of the history of recent efforts toward the introduction of native plants is given in the preface to the catalogue of 1891.

Formerly, the term "American plants" had a technical meaning in England. William Paul in his book on "American Plants," published in London in 1858, writes as follows: "The history of American plants may be briefly told. The term is popularly applied to several genera, principally belonging to the natural order Ericaceae. They are generally 'evergreen,' producing their flowers for the most part in the months of May and June." The book is devoted largely to rhododendrons, azaleas and kalmias, although European and other heaths are included.

There is a strong tendency toward the production of peculiarly American types and races even in species domesticated from other countries, as of the carnation and sweet pea. As American plant-breeders give greater attention to native species, the divergencies between the horticulture of the Old World and that of the New World will be accentuated. The recent multiplication of books about native plants has stimulated interest in the indigenous resources.

L. H. B.

NAUMBURGIA: *Lysimachia*.

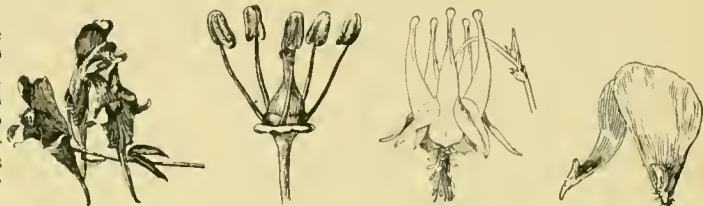
NAUTILÓCALYX (apparently *nautilus-shaped calyx*). *Gesneriaceae*. Herbs of Trop. S. Amer., usually referred to *Episcea*, but lately separated and re-defined by Sprague (Kew Bull. 1912, 85). As now constituted, it comprises species named in *Episcea* and *Alloplectus*, 9 being included altogether. Two of these may be mentioned here, although apparently not in the American trade. The species of *Nautilocalyx* have the general habit and appearance of *Episcea*, but differ in having ovules on the inner surface only of the placental plates rather than on both surfaces. They are distinguished from *Alloplectus* in being herbs rather than shrubs and undershrubs, and in bearing a larger corolla-limb.

N. Förgetii, Sprague (*Alloplectus Förgetii*, Sprague). Fls. pale yellow, corolla hairy outside, the calyx-segms. much shorter than the corolla-tube; lvs. with very wavy margins, somewhat truncate at base, green above and red along the ribs and veins beneath; petioles 2 in. or less long, villous. Peru. *N. pallidus*, Sprague (*Alloplectus pallidus*, Sprague). Fls. creamy white, the corolla hairy outside and the front part of the tube purple-striped inside and the back part with broad band of purple blotches; lvs. gradually narrowed to

base, nearly glabrous above, minutely puberulous beneath. Peru. B.M. 8519.

L. H. B.

NECTAR. Most flowers pollinated by insects possess nectar-glands, simple or composite, located upon some part of the floral structures. To designate nectar by its chief constituent would be simply to call it a sugar solution, more or less watery or dense, depending upon the flower, or upon the conditions under which produced. However, several sugars may be present, as well



2452. Various forms of nectaries. Left, the nectar-spurs of *Linaria vulgaris*; the cushion-like nectaries in a grape flower; nectaries of columbine; right, the nectar-scales on petals of *ranunculus*.

as small quantities of other substances. Just as in honey, the predominant form is fruit-sugar, with cane-sugar next in importance, and always with small amounts of aromatic substances yielding the odor and affecting the taste of the product. Sometimes mucilaginous substances are present. Honey contains less water than nectar, also other aromatic compounds and small amounts of waxes and pollen. The abundant secretion of nectar is, to a large extent, dependent upon external conditions, and usually is favored by conditions inducing the perfection of the flowers.

Nectaries occur on various parts of the flowers, often about the base of one or more petals, or even stamens; again, they may take the form of glandular protuberances or ridges arranged between any of the whorls of floral members; while the most interesting and conspicuous modifications involving the nectaries are those in which one or more of the petals or other floral leaves may be changed into pockets, spurs, or receptacles. Some of the interesting types of modification may be noticed in the violet, columbine, nasturtium, and certain orchids. An extreme form is found in a Madagascar orchid, *angræcum*, in which the nectar-tube may be 6 inches long. Various nectaries are shown in Fig. 2452. In all cases, the nectar is secreted from glandular cells located either superficially or more deeply in the tissues, and in the latter case connected with the receptacle by nectar-ducts. The secreting cells may be confined to a single small spot or may be spread over a larger area or zone.

The development of the curious and complicated nectaries referred to indicates a remarkable adjustment for insect pollination, and whatever may be the immediate explanation of the development of these structures, they serve a most useful purpose in effecting cross-pollination. It is necessary to add, however, that the secretion of sugary liquids by plants is not confined to nectaries, and oftentimes the relation of these secretions to any useful purpose is not clear. The production of "honey-dew" by certain plants, normally or through the incitation of aphid punctures, is allied to nectar-secretion. The opportunities determining the excretion of sugars by nectaries have been considerably studied by physiologists; but, for these facts, the reader must seek information in papers dealing more extensively with the osmotic properties of cells, as the subject is too technical for discussion here.

B. M. DUGGAR.

NECTARINE, a smooth-skinned peach (*Prunus Persica* var. *nucipersica*). Fig. 2453. It was formerly thought to be a distinct species of plant. By DeCandolle it was called *Persica larvis*. Roemer in 1847 made



2453. Nectarines.

two species of it, *Persica violacea*, the freestone nectarines, and *P. laevis*, the clingstone nectarines. It is now known, however, that nectarines often come from seeds of peaches, and peaches have come from seeds of nectarines; and yet it is not impossible that a distinct species is involved in the nectarine group. Either may originate from the other by means of bud-variation. (See Darwin's "Animals and Plants under Domestication" for historical data.)

The cultivation of the nectarine is in all ways like that of the peach. Because of the smooth skin of the fruit, it is perhaps more liable to the attacks of *cureulio*. It is less popular in the market than the peach, and therefore is less grown, although in California it is planted on a commercial scale. In that state it does well on almond stocks. Nectarines are usually inferior to peaches in quality, probably because less attention has been given to the breeding and selection of varieties, and from the fact that there is no conventional standard of excellence. Nectarines thrive in the peach regions. Varieties are few, as compared with peaches. The most prominent in this country are Boston, Downton, Hardwick, Early Newington, Pitmaston Orange, Stanwick, Humboldt, Lord Napier, Advance, Elruge. In color, size and season, nectarines vary as do peaches. See also *Peach*, and *Prunus*.

L. H. B.

The nectarine is grown in California almost exclusively for drying and canning, and even for these uses is but of minor importance. As compared with peaches for canning, the product of nectarines is only about one-eighth of 1 per cent that of the peach, and for drying only about 1 per cent that of the peach. The varieties grown for both canning and drying are the white varieties, because they do not color the syrup in canning and because when sulfured they make a beautiful amber-colored translucent product. E. J. WICKSON.

NEGÚNDO: *Acer*, page 204.

NEILLIA (named after Patrick Neill, at the beginning of the nineteenth century secretary of the Caledonian Horticultural Society at Edinburgh). *Rosaceae*. Ornamental shrubs chiefly grown for their graceful habit, the handsome bright green foliage and the attractive flowers.

Deciduous: lvs. stipulate, alternate, short-petioled, doubly serrate and usually more or less lobed; fls. in racemes; calyx-tube rather large, campanulate or almost tubular, with 5 short erect sepals exceeding the 5 oval petals; stamens 10-30, carpels 1 or 2 with terminal slender styles; pod dehiscent only at the inner suture, with several shining seeds. From *Spiraea* it differs, like the allied genera *Physocarpus* and *Stephanandra*, by its stipulate lvs. and shining crustaceous seeds.—About 10 species in China and the Himalayas.

The neillias are graceful shrubs, with spreading branches, bright green generally ovate leaves and with pink or whitish rather small flowers in terminal racemes.

N. sinensis, which is the handsomest of the species in cultivation, and *N. longeracemosa* have proved fairly hardy at the Arnold Arboretum, while *N. thyrsoiflora* requires protection even in the Middle States, and is often killed to the ground in severe winters, but usually vigorous young shoots spring up and bloom and fruit in the same season. On account of their graceful habit and handsome foliage they may be used as border plants for shrubberies. They grow in any good moderately moist soil. Propagation is readily effected by green-wood cuttings under glass and also by seeds treated like those of *Spiraea*.

A. Fls. whitish; racemes collected into terminal panicles.

thyrsoiflora, D. Don. Upright shrub, to 6 ft. high, but usually not exceeding 2 ft. if annually killed to the ground: branches angular, glabrous: stipules rather large, serrate: lvs. ovate to ovate-oblong, cordate at base, long-acuminate, usually 3-lobed, incised-serrate, glabrous above, pubescent on the veins or glabrous beneath, 2-4 in. long; fls. short-pedicelled, in terminal and axillary racemes $1\frac{1}{2}$ -3 in. long and crowded into terminal panicles, rarely solitary; calyx-tube campanulate, pubescent, with the sepals about $\frac{1}{4}$ in. long. Aug., Sept. Himalayas. R.H. 1888, p. 416.

AA. Fls. pink; racemes solitary.

longeracemosa, Hemsl. Shrub, to 10 ft.: branchlets terete, pubescent: lvs. ovate to ovate-oblong, acuminate, rounded or subcordate at the base, incised-serrate, rarely 3-lobed, glabrous above, pubescent on the veins and veinlets beneath, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long; stipules lanceolate, entire: fls. pink, about $\frac{1}{4}$ in. long, short-pedicelled, in dense racemes $1\frac{1}{2}$ -3 $\frac{1}{2}$ in. long or sometimes longer; calyx tubular-campanulate; ovary bairy only at the apex. June, July. W. China.

sinensis, Oliver. Fig. 2454. Shrub, to 6 ft.: branchlets terete, glabrous: lvs. ovate to ovate-oblong, acuminate, rounded at the base, incised-serrate, usually lobed,

2454. *Neillia sinensis*. ($\times \frac{1}{2}$)

sparingly hairy or nearly glabrous, $1\frac{1}{2}$ – $2\frac{1}{2}$ in. long; stipules lanceolate, entire, usually conspicuous: fls. about $\frac{1}{2}$ in. long, slender-pedicelled, in terminal racemes 1– $2\frac{1}{2}$ in. long; calyx tubular, glabrous or with glandular bristles; ovaries hairy at the apex. May, June. Cent. China. H.I. 16:1540.

N. affinis, Hemsl. Closely allied to *N. longeracemosa*. Branchlets glabrous: lvs. broader, nearly glabrous; racemes shorter; calyx sometimes bristly; ovary villous. W. China.—*N. amurensis*, Nichols.=*Physocarpus amurensis*.—*N. opulifolius*, Brew. & Wats.=*Physocarpus opulifolius*.—*N. Tanaka*, Franch. & Sav.=*Stephanandra Tanaka*.—*N. tibetica*, Franch. Closely allied to *N. longeracemosa*. Lvs. cordate, pubescent beneath, slightly 3-lobed; stipules ovate, often sparingly toothed; calyx-tube cylindric, pubescent and often bristly; ovary silky pubescent. W. China.—*N. Torreyi*, Wats.=*Physocarpus monogynus*.

ALFRED REHDER.

NELUMBO (Ceylonese name). Usually written *Nelumbium*. *Nymphaeaceae*. NELUMBIUM. Two strong-growing aquatics, one yellow-flowered and native to North America, the other white or cyanie-flowered and native of the Orient.

From *Nymphaea*, or the true water-lilies, *Nelumbo* differs technically in having distinct carpels, which are imbedded in the receptacle, with a single ovule in each. *Nelumbiums* have strong and thick and usually tuber-bearing rhizomes, which creep in the earth in the bottoms of ponds and slow streams: lvs. peltate, orbicular or nearly so, entire, usually very large and long-petioled and mostly standing high above the water (floating when from young plants or in deep water): fls. large and showy, single, on peduncles which equal or exceed the lvs.; sepals 4 or 5; petals many, erect or erect-spreading; stamens many, on broad, short filaments: fr. a large, flat-topped perforated receptacle (Fig. 2455), in which are immersed the many carpels. The bold and characteristic form of the *nelumbiums* lends itself well to conventional designs, as in Fig. 2456.

Nelumbiums are bold plants, suitable for large ponds and for masses. They may be grown in tubs, or better in the open pond, as the rhizomes may run 30 or 40 feet in a year. *N. lutea* flowers well only when thoroughly established and in entire freedom; it is sometimes crowded out by *N. nucifera*. The latter species, commonly but incorrectly known as Egyptian lotus, is one of the best of large pond plants, being grown for its stately habit and showy flowers. Its roots should not freeze. Covering the pond with boards and litter, or filling it with water, may be made to afford ample protection.

A. Fls. yellow.

lutea, Pers. AMERICAN LOTUS, or NELUMBO. WATER CHINKAPIN. Lvs. usually raised 2–6 ft. out of shallow water, cupped or depressed in the center over the attachment of the petiole, 1–2 ft. across: fls. pale sulfur-yellow, 4–10 in. across, with obovate-obtuse concave petals and hook-appendaged anthers. S. Ont. to Minn., Neb., Fla. and La.; usually local. G.F. 9:375. Mn. 10:113. V. 19:9.—A bold and useful plant for colonizing, deserving to be better known. *N. flavescescens*, Hort., produces more but smaller fls. and has a red spot at center of lf.; possibly a hybrid.

AA. Fls. pink, red or white.

nucifera, Gaertn. (*Nelumbium speciosum*, Willd. *Nelumbo indica*, Pers., and *N. Nelumbo*, Karst.). EAST INDIAN LOTUS. Fig. 2455. Lvs. usually larger than those of *N. lutea*, glaucous: fls. fragrant, usually pink except in horticultural varieties, overtopping the lvs. Caspian Sea to Japan, Philippine Isls., India and N. Austral.; naturalized at Bordentown, N. J., where it was intro. by E. D. Sturtevant. A.G. 15:334. C.L.A. 4:275; 5:301. G. 7:16; 28:395. Gn. 28, pp. 426, 429; 43:463; 44, pp. 229, 435; 50, pp. 267, 469; 57, p. 397; 66:171; 76, p. 447. Gng. 5:114; 6:295; 15:334. G.C. III. 52:119. G.M. 38:809; 40:34; 41:333–5. G.W. 2:377. I.H. 42:27. R.H. 1900, p. 243. V. 15:97.—This plant is known to the trade as Egyptian lotus, but the lotus of

the ancient Egyptians is a *Nymphaea*. This plant is not native to the Nile region. Many named forms are cult., e.g.: Fls. white: Var. **álba** (*N. álba*, Hort.), the "magnolia lotus." Gn. 28, p. 427. G.C. III. 14:41. Var. **álba grandiflora**, larger-fl. A.F. 14:726. A.G. 20:369. Gng. 7:146. Mn. 9:73. Var. **álba striata**, edge of petals striped and tipped with red. Var. **pygmæa álba**, dwarf: lvs. 6 in.: fls. 4 in. across. Var. **álba plèna** (*N. Shiròman*), large, double Japanese form. A.F. 16:229. F.E. 10: suppl. Feb. 12. Gn. 60, p. 158. Gng. 9:3. Var. **pygmæa álba plèna**, dwarf, double. Fls. pink to red: Var. **Kinshiren**, white shaded pink. Var. **kermesina**, light rose. Var. **Grossherzog Ernst Ludwig** (= *N. flavescescens* × *N. Osiris*),



2455. The Indian lotus, *Nelumbium speciosum*, of the trade, but properly *Nelumbo nucifera*.

salmon-rose. Var. **pygmæa ròsea**, dwarf, bright rose. Var. **ròsea**, Hort., deep rosy pink. Var. **Osiris**, deep rose. Gn. 72, p. 457. Var. **púlchra**, dark rosy red. Var. **pekinénsis rùbra**, rosy carmine. Var. **gigantèa**, very large, rose-purple. Var. **ròsea plèna**, double, deep rosy pink. G.W. 5:411. Var. **pekinénsis rùbra plèna**, very large, double, rosy carmine.

II. S. CONARD.

Nelumbium in cultivation.

Whilst it may be historically true that the Egyptian lotus is not a *Nelumbium*, the *Nelumbium speciosum* (or more properly *Nelumbo nucifera*) is everywhere known under that name, and it has been so distributed in good faith. In fact, it is doubtful whether it is worth while to change the common name at this time.

America may be honestly proud of possessing such a fine aquatic plant as *Nelumbo lutea*, the well-known American lotus. While China and Japan are the recognized homes of the splendid *Nelumbo nucifera*, they do not possess a yellow lotus. In the central states

and near the Great Lakes, *N. lutea* is found in abundance, but it is scarce in the Middle Atlantic and eastern states. When well established it is a magnificent plant, and when in blossom it is a sight worth traveling miles to see.

Nelumbiums, with nymphaeas and other aquatic plants, were among the few flowers known or cultivated by the ancients. No mention is made in history of a yellow lotus prior to the discovery of America by white men, but over four centuries ago it was well

known to the Indians and cultivated by them in the waters of the Tennessee and Cumberland rivers, and was abundant on the tributaries of the Mississippi. It was carried northward and eastward by the Indians, and was established as far east as Connecticut. At the present time (1914), it is established and cultivated in most of the states of the Union.

The late Isaac Buchanan received tubers of *N. nucifera* from Japan, which were planted in a

stream on Long Island, but there they perished. Later, other efforts were made, and some tubers from the same source were received and planted by Samuel Henshaw in an artificial pond in the gardens of the late Mr. Green, at New Brighton, Staten Island, New York, where they grew most satisfactorily, some of the original stock being still in evidence on the estate.

About the same time E. D. Starrevant, of Bordentown, New Jersey, who had introduced a number of tender water-lilies into commerce, and knowing of its being grown in the Jardin des Plantes, Paris, made an examination of the condition under which it existed there and determined to experiment in the culture at Bordentown, New Jersey. Roots were obtained from Kew Gardens and afterward planted in shallow water in a sheltered spot in a millpond near Bordentown. Here the plant grew amazingly, and its success and hardiness were fully established. From here was disseminated the now famous Egyptian lotus, *Nelumbo nucifera*, to all parts of the United States. Several varieties have since then been introduced from Japan, including white and delicately tinted varieties, also deep rose, and double forms of both white and rose.

The cultivation of the nelumbium is of the simplest. The roots or tubers should not be transplanted until there is evidence of growth, as the tubers, being usually buried deep in the soil below the water and out of the reach of frost, are not affected by the warm rays of sunshine as early as nymphaeas and other terrestrial plants. If nelumbiums are dug before they start into growth, the tubers should be kept in a warm place or planted where the temperature is such that growth will begin at once. In the Middle Atlantic States and eastward and westward, May is the best time to transplant; southward earlier. Tubers may be planted in shallow water near the margin of the pond where it is intended they shall grow. The tuber should be placed horizontally in the soil, first making a little trench or opening

to receive the same and covering with about 3 inches of soil. Means must be employed to keep the tuber securely in position and, if necessary, a stone or brick laid over the tuber. When the season is late or circumstances delay the planting season until June, it will be safer to secure plants in pots or tubs. These, beside being somewhat advanced, will transplant with a greater degree of certainty and more satisfactory results. In artificial ponds a walled section should be built to hold the soil and keep the roots within bounds. The walls should have no corners at right angles; where there are such they should be rounded off, so that the runners are not intercepted and crowded in bunches at the corners. The natural soil and deposits in ponds are, in most cases, all that is required for these plants. They will flourish equally well in a stiff or tenacious soil, but when grown in artificial ponds it is best to use a mixture of two parts turfy loam and one part thoroughly rotted cow-manure. Do not use fresh or green manure, and when possible have sods cut in the fall and stacked with the manure (in this case it may be fresh). In early spring, have the same turned over two or three times before using. Resort may be had to cultivation in tubs, but the lotus being such a gross feeder, the result in most cases is that the plants are starved into rest at an early date. The leaves turn a sickly yellow and present a sorry appearance, and in many cases produce no flowers. If no other method can be adopted, then secure the largest tubs possible and during the growing season use liquid or artificial manure liberally. An excellent method to grow nelumbiums under artificial conditions is to excavate a hole 5 to 6 feet in diameter and 2½ feet deep with slightly sloping sides. Have a form in readiness to place inside the excavation, leaving about 4 inches clear for concrete. The form can be of light material, the size of the pool desired, so braced as to hold the concrete in place until set. Place heavy chicken wire netting in the opening for reinforcement and secure in place when filling so as to be in the center of wall. When finished, this makes an ideal pool for nelumbiums or water-lilies, watertight and frost-proof. Use two bags Portland cement, three wheelbarrows of sand and five wheelbarrows gravel or finely broken stone.

It must be understood that while the nelumbiums are hardy, they are so only as long as the tubers are out of the reach of frost. The depth to which frost penetrates the soil or water may be termed a dead-line.

The tubers are farinaceous and edible, and are of considerable market value in Japan, but a taste must first be cultivated for them in the United States. The muskrat, however, has developed a highly cultivated taste for these sacred morsels, and it is necessary to watch these animals lest they take up their abode near ponds where the nelumbiums grow. There are now in cultivation in the United States a dozen or more varieties, including single and double forms, pure white to deep rose, and yellow.

As to insect pests, black-fly or black aphid is sometimes troublesome. The best remedy is the lady-bird beetle and its larva. Also spray with tobacco water. The leaf-cutter, or roller, is prevalent in some sections, and both young and old leaves are attacked, also the stems of the leaves and flowers. These have their natural enemies in the form of wasps and even sparrows, and as no liquid insecticide can be used, only such as are in the shape of a dry powder can be depended on. Paris green, mixed with land plaster or plaster and powdered slaked lime, is excellent, but dry hellebore in powder-form, or slugshot applied by a powder bellows is the best material to exterminate them. A borer in the leaf-stalks sometimes does great damage, killing nearly all the leaves, so that no blooms are made. Apply "slug-shot" with a bellows. Sometimes the diseased leaves are mowed off and destroyed, and a second growth may escape the borers.

WM. TRICKER.



2456. Metal fountain in Nelumbo form.

NEMASTYLIS (Greek, *thread-like styles*, because the styles are not united). Syn., *Nemastylus*. *Iridaceæ*. Tender American bulbs, with blue six-lobed flowers about an inch across which last only a day.

Erect plants, with slender, usually branched sts.: root-lvs. linear; spathes 1 or more, peduncled; fls. rather large, more than 1 to a spathe; perianth of 6 segms. without a tube; inner segms. a little smaller than the outer; ovary 3-celled; filaments more or less united; anthers short; ovules many, superposed; style-branches alternate with the anthers; caps. loculicidally 3-valved, oblong, ovoid or obovoid.—Strictly, *Nemastylis* is a genus of 3 species, found only in the S. U. S. and characterized by having the filaments nearly free. Baker, however, in his Handbook of the Iridæ, includes *Chlamydostylis* as a subgenus of 17 species found from Mex. to S. Amer. and characterized by having the filaments united in a column to the summit. Some of the following species have been rarely advertised by dealers in native plants; the others by Dutch bulb-growers.

A. *Filaments nearly free.* (Subgenus *Nemastylis proper.*)

B. *Cluster of fls. single: spathes usually 1-fl.*

celéstina, Nutt. Root-lvs. 1-2, 1 ft. or more long; st. $1\frac{1}{2}$ -2 ft. long, bearing 3-4 reduced lvs.: fls. sky-blue. Pine barrens, Fla. to Ga., and westward through Texas.—Differs from *N. acuta* in having more broadly ovate perianth-lobes.

BB. *Clusters of fls. 2-3: spathes 2-3-fl.*

acûta, Herb. (*N. geminiflora*, Nutt.). NORTHERN NEMASTYLIS. Root-lvs. 2-3, $\frac{1}{2}$ -1 ft. long; st. $\frac{1}{2}$ ft. long, bearing 1 large linear lf. at the fork, and sometimes another below it; fls. bright blue or purple; bulb dark colored, ovoid, scaly, 1 in. or less long; caps. obovoid. Texas, to Mo., La., and Kans., Ark. and Tenn. B.M. 6666. F.S. 21:2171.

AA. *Filaments united in a column to the summit.*
(Subgenus *Chlamydostylis.*)

B. *Fls. brownish purple, inner segms. tipped yellow.*

brúnnea, Wats. St. 1 ft. long, bearing a single lf. 6-8 in. long and a sheathing bract at the base of the peduncle; spathe $2\frac{1}{2}$ in. long, several-flid.: outer perianth-segms. obtuse, inner ones acuminate, brown-purple, the inner segms. tipped yellow; anthers yellow. Mex.

BB. *Fls. pale blue.*

Pringlei, Wats. St. usually simple, with a single lf. at the middle; radical lvs. shorter than st., 2-3-nerved; spathe $1\frac{1}{2}$ in. long; fls. fragrant; outer segms. obtuse, inner ones minutely apiculate, pale blue; caps. oblong. Mex., province of Chihuahua. WILHELM MILLER.

A. C. HOTTES.†

NEMESIA (old name used by Dioscorides for some sort of snapdragon). *Scrophulariaceæ*. The genus includes attractive flower-garden half-hardy annuals.

Herbs annual or perennial, sometimes undershrubs, the annual kinds having come into cult; lvs. opposite; fls. very variable in color, from yellow to white and purple, in terminal racemes or axillary (racemose in the garden kinds), the pedicels bractless; calyx 5-parted; corolla with short tube which in front bears a spur or pouch; corolla-limb 2-lipped, the upper or posterior lip 4-notched or -cleft and the lower or anterior of one shallow-notched or entire lobe with palate at base; stamens 4, didynamous, the anthers 1-celled and usually cohering about the stigma; ovary 2-celled; caps. with boat-shaped valves.—Species about 50, of which a very few are Trop. African and the remainder S. African. Cf. Hiern, *Flora Capensis*, IV: II (1901). *N. strumosa* was one of the horticultural novelties in the last part of the 19th century. The fls. are very distinct in shape and have a wide range of color. They are about an inch across and borne in great profusion. If started

indoors in March and transferred to the open in May the plants will furnish continuous bloom from June to Sept. The colors range from white, through pale yellow and rose, to orange and crimson, with numerous intermediate shades and a great variety of throat markings. This species has been known to botanists nearly a whole century; it grows only 50 miles from Cape Town, and it exhibits all these colors in the wild, yet it was never exploited until 1893, the first live plants seen in Eu. being shown in 1892. Sixteen distinct color varieties were recognized in the first batch of cult. plants, and the process of selecting strains has probably only begun. The nemesias are of easy cult. They may stand about 6 in. apart in the garden beds.

A. *Fls. with a sac or pouch at the base.*

strumôsa, Benth. Fig. 2457. Erect, branches, 4-angled, glabrous below and more or less pilose above, 6-24 in. high: root-lvs. oblong-spatulate, entire or dentate; st.-lvs. lanceolate or linear, dentate, sessile; racemes in wild plants, 2-4 in. long, terminal, becoming sub-corymbose and afterward elongating; fls. white or in shades of yellow and purple, often purple-marked on the outside, the bearded throat spotted on a yellow ground; upper lip about $\frac{1}{2}$ in. long and often 1 in. broad; lower lip about 1 in. broad; caps. 4-6 lines long, 3-4 lines wide. S. Afr. B. M. 7272. G.C. III. 12: 277. R.H. 1898, p. 87 (var. *grandiflora*). V. 16:7. G. 31:315.—It varies into a number of forms, some of them compact. Var. *Suttonii*, Hort., is a series of improved forms, with large fls. of many colors, pale yellow, rose-pink, white, rich orange, crimson and scarlet being now offered separately. G. M. 35: 459; 43:311. Gn.W. 9:289; 18:637. J.H. III. 51:58.



2457. *Nemesia strumosa.*
($\times 14$)

AA. *Fls. with a spur at the base.*

versicolor, E. Mey. Erect or ascending, nearly glabrous below and slightly pilose above, simple or branched, 1 ft. or more high: lowest lvs. somewhat stalked and ovate or narrower; upper lvs. few, sessile, oblong, lanceolate or linear, entire or toothed; racemes sub-corymbose and lengthening, 1-3 in. long in the wild; fls. "variable in color, either white and striate outside or cinnabar-red, striate outside and sulphur-colored on the throat or sulphur-colored and not striate" (Hiern); lobes of the upper lip equal among themselves and as long as the lower lip; throat with 2 callosities, pubescent; spur incurved or nearly straight, about as long as the lower lip. S. Afr. Var. **compâcta**, Hort. (*N. compâcta*, Hort.). A compact and attractive free-flowering race, 8 in. to 1 ft., excellent for borders and rock-gardens, with fls. in white, rose, violet, and blue. Var. **compâcta tricolor**, Hort., has white, rose, and violet in the fls. R.H. 1898, p. 87.

floribûnda, Lehm. Erect, 6-15 in., glabrous below and somewhat pilose above, the sts. 4-angled; lower lvs. stalked, oval or ovate, dentate; upper ones few, small, ovate or lanceolate, subsessile; racemes rather open, subcorymbose or oblong, 1-5 in. long in the wild; fls. whitish; upper corolla-lobes oblong, very short; lower

lip somewhat longer and 2-lobed; mouth closed; spur nearly straight and obtuse long-conical. S. Afr. B.R. 24:39.—Fls. smaller and with a narrower range of colors than in *N. strumosa*.

lilacina, N. E. Br. Much branched, minutely glandular-pubescent, to 15 in. high; lvs. narrow-lanceolate, to $1\frac{1}{2}$ in. long, toothed; racemes to about 1 ft. long, loose, the pedicels slender; fls. small, lilac; upper lip scarcely $\frac{1}{4}$ in. long, purple-striped; lower lip about same length, yellow-marked on the palate; spur whitish, short. German S. W. Afr.

WILHELM MILLER.
L. H. B.†



2458. *Nemopanthus mucronata*.
($\times 14$)

NEMOPÁNTHUS (from the Greek, referring to the thread-like flower-stalks). Also spelled *Nemopantes*. *Aquifoliaceae*. MOUNTAIN HOLLY. Ornamental shrub planted for its attractive fruit and handsome foliage.

Deciduous; lvs. alternate and partly fascicled, slender-stalked, entire or slightly toothed; stipules small, caducous; fls. polygamo-dioecious, small, whitish, 1 or few on slender axillary pedicels; calyx in the staminate fls. of 4-5 deciduous teeth, ovate in the fertile fl.; petals distinct, 4-5, linear; stamens 4-5, free, with slender filaments; fr. a drupe with 4-5 bony nutlets.—One species in N. E. N. Amer. Closely allied to *Ilex*, which differs chiefly in the persistent calyx and in the stamens being adnate to the petals, which are slightly united at the base.

The mountain holly is a much-branched upright shrub with medium-sized generally oblong bright green leaves, inconspicuous whitish axillary flowers followed by attractive globose red fruits on slender drooping stalks. It is hardy North and prefers moist soil; it does well in partly shaded situations. Propagation is by seeds; also by greenwood cuttings under glass.

mucronata, Trel. (*N. canadensis*, DC. *N. fasciculáris*, Raf. *Hicoides mucronata*, Brit.). Fig. 2458. Shrub, to 10 ft.: young branches purplish, older ones ashy gray; lvs. elliptic-oblong, mucronate, entire or sometimes slightly toothed, paler beneath, glabrous, 1-1½ in. long; fls. solitary or few, small, on slender peduncles ½-1 in. long; fr. subglobose, ¼-½ in. across, dull red. May, June; fr. in Aug., Sept. Canada to Wis., Ind., and Va. B.B. (ed. 2) 2:490. I.T. 3:81.

ALFRED REHDER.

NEMÓPHILA (Greek, *nemos*, a grove, and *phileo*, to love; referring to the habitat of some species). *Hydrophyllaceae*. Hardy annual herbs blooming abundantly from early spring to late summer.

Whole plant more or less hairy; st. diffuse, becoming prostrate; lvs. alternate or opposite, pinnately lobed or divided, petiolate; fl.-stalks usually longer than the lvs., terminal or lateral, slender, 1-fl., in one or two species inclined to be racemose; fls. blue, white, purple, or variously spotted; calyx 5-parted; lobes erect or spreading, with 5 supplementary reflexed lobes alternating with them, increasing in size when fruiting; corolla broadly bell-shaped or wheel-shaped, deeply

5-lobed, with 10 sealy appendages on the inside of the throat; ovary hairy; styles glabrous; caps. globose, hairy, smaller than calyx-lobes. The chief source of information is in the monograph of the *Hydrophyllaceae* in *Das Pflanzenreich*, lft. 59, p. 42, by A. Brand; also in *Syn. Flor. of N. Amer.*, vol. 11, part 1, p. 155, by Asa Gray. Brand recognizes 18 species and over 50 subspecies and varieties, all from N. Amer.

Nemophilas are of dwarf, compact habit, and produce an abundance of showy bell-shaped flowers from early spring to late summer; hence they are valued for bedding and for the border.

A. Lvs. mostly alternate, all with an ear-shaped and clasping base or winged petiole.

aurita, Lindl. St. 1-3 ft. long, weak, with stiff, recurved bristles by which the plant tends to climb; lvs. mostly alternate, the lower opposite, deeply cut above into 5-9 oblong or lanceolate segms, which are usually turned back: later fls. not accompanied by lvs., and hence appearing to be in loose racemes; corolla about 1 in. broad, violet. Blooming from March till May, low, shady grounds. Calif. from Sacramento Valley to San Diego. B.R. 1601.

phacelioides, Nutt. Sparsely hairy, 1-2 ft. tall; lvs., all but earliest, alternate; lf.-segms. obtuse, margin slightly ciliate; lower lvs. narrowed into a short naked petiole; lobes notched at end; corolla bell-shaped, blue with white or pale center; seeds slightly pitted. Low ground. W. N. Amer., Ark., Texas. B.R. 740. B.M. 2373.

AA. Lvs. opposite.

B. Fls. one color, or dotted or veined.

Ménziesii, Hook. & Arn. (*N. atomaria*, Fisch. & Mey. *N. modesta*, Kellogg. *N. pedunculata*, Benth.). St. straggling, succulent, procumbent, pilose; lvs. pinnatifid, the lobes ovate, nearly entire, slightly hairy; fls. light blue to nearly white, marked with dark brown spots toward the center or sometimes with a dark eye. Low grounds, W. Amer., Calif. to Ore. B.R. 1940. B.M.



2459. *Nemophila Menziesii*
var. *insignis*.
($\times 12$)

3774. P.M. 5:99. V. 2:267. Brand makes 19 subspecies and botanical varieties of this species, of which some are important horticulturally. Var. *discoïdalis*, Hort., in which the spots on the corolla are confluent into a large, brownish purple eye. Other garden forms are: var. *vittata*, Hort., velvety black margined with white (Gn. 9, p. 232); var. *elegans*, Hort. (*N. atomaria* var. *elegans*, Hort.), fls. pure white, with chocolate center.

(V. 2:268); var. *oculata*, Hort., white, with purple center, and var. *argentea*, Hort., white fls., lilac stripes.

Subsp. *insignis*, Brand. BABY BLUE-EYES. Fig. 2459. Lvs. pinnately parted into 7-9 oblong segms., which are sometimes 2-3-lobed or toothed; fls. $\frac{1}{2}$ -1 in. wide; corolla bright clear blue, the scales within its base short, partly free, covered with short hairs. Low ground, Calif. B.R. 1713. B.M. 3485. P.M. 3:151. V. 2:268; 5:168; 8:215. Gn. 74, p. 367.—There are many garden varieties. Among these are var. *grandiflora*, with large, clear blue fls. (Gt. 34:370); var. *alba* fls. pure white; var. *marginata*, or *variegata*, Hort., fls. blue, edged with white.

Var. *crambeoides*, Hort. Corolla 15-18 in. diam., light blue, veined not spotted.

BB. Fls. white; corolla-segms. each spotted deep purple.

maculata, Benth. Lvs. lyre-shaped, the 5-9 short lobes obtuse, entire; upper lvs. wedge-shaped, sometimes only 3-lobed; fls. white, with a deep purple blotch at the apex of each of the broad lobes, 1-2 in. wide, showy; sometimes the purple blotch is poorly defined. Common in W. and Cent. Calif. Blooms April and May. P.M. 16:6. F.S. 5:431. R.H. 1849:201. V. 2:267. J.H. III. 51:567.—Good garden forms of this are var. *albida* and var. *grandiflora*. Var. *variegata* has variegated lvs.

S. W. FLETCHER.
A. C. HOTTES.†

NENGA (Malayan name). *Palmaceae*. A few graceless spineless feather-leaved Malayan palms, one of which is cultivated as *Areca pumila*.

In *Areca*, the ovule is erect and fastened at the base, while *Nenga* belongs to a large group in which the ovule is attached on the side and more or less pendulous. *Nenga* is distinguished from the 5 cult. genera of this group (which are listed under *Hedyoscepe*) by the following characteristics: staminate fls. with narrow sepals much surpassing the petals; stamens 6; anthers erect. Trunks erect, slender, ringed; lvs. terminal, equally pinnatisect; segms. linear, acuminate or obliquely 2-fid or 3-fid; margins folded back at the base; primary nerves sparsely scaly below; rachis 3-sided; petiole short; sheath cylindrical, strongly oblique at the throat; spadix with a short peduncle and slender pendent branches; spathes 2, the lower symmetrical, lanceolate, folded, 2-crested, the upper unsymmetrical, persistent, or lacking; bracts 3-fld.; bractlets scaly; fls. white; fr. ellipsoidal, smooth, reddish orange. Cult. as in Kentia.

Wendlandiana, Scheff (*Areca pumila*, Blume). St. 10-20 ft. high, 2-3 in. diam.; lvs. 8-9 ft., pinnate nearly to the base; pinnae alternate, ensiform, acuminate, $2\frac{1}{2}$ ft. long, $\frac{1}{2}$ -1 $\frac{1}{2}$ in. wide, bright green, coriaceous, 2-ribbed; petiole slender; sheath sub-ventricose, 2 ft. long. Java.

JARED G. SMITH.

NEOBENTHAMIA (in honor of Geo. Bentham). *Orchidaceae*. Orchids with slender leafy sts.: fls. in racemes; sepals and petals similar, contracted, the lateral sepals forming a short chin with the column-foot; lip fleshy, entire, crisped on the margin; column short and thick; anther helm-shaped, upright; pollinia 2, with short stalks.—Species 1, in Zanzibar.

gracilis, Rolfe. Sts. up to 4 ft. long, sparingly branched; lvs. linear, acuminate, sheathing at base; fls. in a short terminal raceme, white, on long pedicels, campanulate; lip spreading from base, obovate-oblong, nearly truncate at apex, disk yellow in middle, with 2 rows of red spots. B.M. 7221. G.C. III. 10:273; 24:430, 431.—Cult. as for *Cymbidium*.

GEORGE V. NASH.

NEOGLAZIØVIA (new *Glazioria*). *Bromeliaceae*. Two Brazilian plants allied to *Billbergia*, but with ovules few rather than many in each locule. Plants terrestrial and on rocks, with spiny lvs. that furnish good fiber for ropes. *N. variegata*, Mez (*Bromelia variegata*, Arr.

Billbergia variegata, R. & S. *Dyckia Glaziovii*, Baker), the Caroá of Brazil, is 3 ft. or more tall, with glabrous or very minutely lepidote lvs., marked with lighter transverse bars in the living specimen; fls. scarlet. *N. cóncolor*, C. H. Wright, the Makimbeira of Brazil, has a very short st.: lvs. uniformly white-lepidote, the younger parts woolly; calyx scarlet and petals violet. B.M. 8348.

NEÓGYNE (new *pistil*). *Orchidaceae*. Pseudobulbous orchids with many-fld. racemes; fls. withering; sepals erect-connivent, free, saccate at base, longer and broader than the flat petals; lip concave, 3-lobed, saccate at base, the lateral lobes large, rounded, inclosing the column, the middle lobe small; column shorter than lateral lobes of lip, winged upward; anther dependent, convex; pollinia 4, waxy, dorsally compressed, the inner face deeply sulcate.—Species 1, native of the Himalayas.

Gardneriana, Reichb. f. (*Calogyne Gardneriana*, Lindl.). Lvs. narrowed into a petiole much shorter than pseudobulb, euneate-elliptic, acuminate, up to 15 in. long and 3 in. wide; fls. white with a lip marked yellow, about 2 in. long. P.M. 6:73. G.W. 15, p. 86.—Cult. of warmhouse *Calogyne*; midwinter.

GEORGE V. NASH.

NEOLAÛCHEA (the type species flowered in the collection of Prince Johannes Liechtenstein, in honor of whose gardener, Herr Lauche, the genus was named). *Orchidaceae*. One species, a native of Brazil, has been described. Primary sts. pro-repent, secondary sts. thickened into 1-lvd. pseudobulbs; infl. terminal; peduncle filiform, 1-fld.; pollinia 8. Closely allied to *Cochia*.

pulchella, Kränz. (*Meiracyllium Wettsteinii*, Porsch.). A small plant with ovate pseudobulbs $\frac{3}{4}$ in. tall, terminated by a linear lf. 4 in. long, scarcely $1\frac{1}{3}$ in. wide; peduncle shorter than the lf.; fl. purplish, about $\frac{2}{5}$ in. long; upper sepal and the petals lanceolate; lateral sepals coherent below the middle, free portion triangular; labellum with the lateral lobes minute, rounded, auriculate; middle lobe rhombic; disk between the lobes thickened, minutely papillose. July.

OAKES AMES.

NEONICHOLSØNIA (name in compliment to the late George Nicholson, curator at Kew, author of Dictionary of Gardening). *Palmaceae*. Two Central American stemless palms with pinnate lvs. 4-6 ft. long, yet little known. Fls. monœcious; male fls. small, trifid, the petals 3 and longer than calyx, stamens connate at base in a short ring, the filaments subulate, anthers long-sagittate and with a thin subulate connective that forms a mucro beyond the apex, pistil a conical rudiment; infl. spicate; allied to *Calyptrogyne*. The genus is founded and the two species described by Dammer in G. C. III. 30, pp. 178, 179 (1901).

N. Georgei, Dammer, has lvs. about $4\frac{1}{2}$ ft. long, petiole and all; pinnules 10 or 11 on each side the rachis, lanceolate, acuminate, with 1 central and 2 marginal primary nerves and 6-8 secondary nerves, 12-16 in. long and $\frac{1}{3}$ -2 in. broad, the first pair opposite and the others alternate, terminal pair confluent only at the base and 8 in. long by 1 in. broad. Costa Rica. *N. Watsonii*, Dammer (named for W. Watson, Nicholson's successor at Kew), differs in its longer lvs., which are about 6 ft. long; and pinnules 9 or 10 on each side, elongate-lanceolate, caudate, 13-18 in. long and 1-2 in. broad, more or less opposite, the terminal pair confluent only at base and 10 in. long by 2 in. broad. Costa Rica.

L. H. B.

NEÓTTIA (meaning a bird's nest, and referring to the curiously interlaced roots). *Orchidaceae*. A very few small terrestrial saprophytic orchids of Eu. and

Asia, sometimes transferred to grounds, but little known as cult. plants. The *N. Petola*, Blume, of orchid collections, is *Macodes Petola*, which see. *N. speciosa*, Jacq., is *Spiranthes*, and *N. pubescens*, Willd., is *Goodyera pubescens*.

Leafless and brown, the st. with sheathing scales rather than lvs.; fls. brownish, in a raceme or spike; perianth hooded; lip deflexed and 2-lobed; column long and free, the anther hinged on the back of it. *N. Nidus-avis*, Linn., is the bird's-nest orchid of Great Britain and the continent, frequenting beech woods particularly; root a mass of interlaced stout fibers from the extremities of which young plants are produced; st. 12-18 in. high; fls. many in a dense spike $\frac{1}{2}$ in. long, with short bracts.

L. H. B.

NEOTTÓPTERIS (name means *bird's-nest fern*). *Asplenium Nidus*, of which *N. australasicum* is by botanists considered to be a synonym, although by others kept distinct. *A. Nidus* is widespread in Tropical Asia and the Pacific Islands, and is a most striking large fern. B.M. 3101. G. 13:85, where distinctions are made between *N. australasicum* and *N. Nidus*.

NEPÉNTHES (from Greek for *without*, and *care*). *Nepenthaceæ*, the only genus of the family. The genus includes those forms that are popularly called PITCHER-PLANTS, and consists of about seventy species, all of which are found in the Orient. The generic name was given in allusion to the statement in the "Odyssey," where Helen so drugged the wine-cup that its contents freed men from care and grief. Linnæus in naming the genus truly expressed the feeling that some travelers have since experienced when he said "If this is not Helen's Nepenthes, it certainly will be for all botanists. What botanist would not be filled with admiration, if after a long journey he should find this wonderful plant? In his astonishment past ills would be forgotten when beholding this admirable work of the Creator."

All of the nepenthes are climbing or rarely upright plants of rather straggling habit and semi-woody consistence. In height they vary from a foot to 60 or 70 feet, while the stem varies from the thickness of a pencil to an inch across. In their native haunts the

plants spread their rootage abundantly through the decaying humus of moist "scrub" land, and when planted in an open greenhouse border, they grow equally vigorously. But the roots always spread near the surface, and free oxygen exchange is necessary. Some of the more striking species, like *N. Veitchii* and *N. Edwardsiana*, are often or habitually epiphytic. The former has become so adapted to this mode of life, that its stem creeps horizontally or obliquely upward along tree branches, while the leaves with their yellow-green

pitchers spread in double rows on either side. Such forms, therefore, succeed only under cultivation when treated like the epiphytic orchids. Well-known species, like *N. ampullaria* and *N. Rajflesiana*, may form long rope-like stems amid the rather open forest vegetation of their native haunts, and then spread out amongst the tree crowns, there to bear the graceful pitchers and the racemes of nectariferous flowers. These latter, according to Burbidge, are often encircled by groups of insects.

Each fully developed leaf is of complicated structure. It may be either sessile or stalked, but always has a lower flattened blade portion, that is traversed lengthwise by two to ten or twelve veins, all of which are braced together in turn by transverse or oblique nerves. The number and disposition of the former yield valuable aid in classification of the species. The midrib is then prolonged as a tendril of varying length, but of great tenacity. This can wind around supports, and alike helps the stem in bearing the crown of leaves, and supports the pitchers with their often considerable weight of water.

The pitcher is the greatly expanded and hollowed-out end of the midrib. It usually bears two fringed or ciliate wings in front, that in the seedling leaf are continuous with the blade below, and gradually become separated from it as older leaves are produced. They represent, therefore, lobes that are separated off from the blade portion in the early history of the leaves. The margin of each pitcher, except in *N. Lowii* (Fig. 2462), is widened or thickened without and within into a collar-like rim or peristome, that is striated, corrugated or even ridged from within outward, and is of shining aspect. The inner, or the outer, or both rim-margins may be curved downward and inward, so as to give a cylindric aspect to the peristome (Fig. 2463), or it may be widely expanded as a spreading collar (Fig. 2465). The pitcher or hollowed-out midrib ends in a small spur at the back of the peristome, and just behind the insertion of the lid that next deserves notice. This lid represents two terminal lobes of the leaf formed on either side of the spur, and which have grown forward, have fused, and so have caused the lid to be traversed by two main veins from which minor ones may branch off.

All of the above details would be comparatively unintelligible did we not refer shortly now to the numerous secreting glands that are formed over the leaf, and to the function of these in securing the capture and digestion of insects or other prey. Over the lower blade surface, here and there along the tendril, over the pitcher and lid exterior, but most abundantly over the inner lid surface, small spots can readily be detected that exude a honied juice. This is greedily licked by ants, cockroaches, and other—mostly running—insects. They are thus attracted to the edge of the peristome, or upward to the inner lid surface with its rich nectar supplies. In either case they usually step ultimately on the shining surface of the peristome. But the finely or coarsely serrated inner edge of this carries the openings of large sunken glands. These exude a juice that is greatly liked by insects. In attempting to reach the droplets they often slide off into the pitcher interior. This shows a different but equally noteworthy device. In some species, like the commonly grown *N. ampullaria*, *N. Hookeriana* and *N. Cheloni*, the entire pitcher interior is smooth and glistening, but abundantly studded with small glands that excrete an acid peptonizing fluid, capable of converting albuminous substances like animal flesh or white of egg into a dissolved peptone or even into a simpler tryptophan product that can readily be absorbed and assimilated by the inner pitcher wall.

In most species and hybrids, however, now under cultivation, the upper one-third or one-half, of the pitcher interior is extremely smooth and bluish or pur-



2460. Good method of propagating nepenthes.

The cutting is placed in an inverted pot. The stick at the right wedges the cutting and keeps it tight; it may also carry the label. The pot is cut in two vertically to show how the roots form in the air, without the aid of sand, water or even moss.

plish waxy in aspect. This forms a sliding or "conducting" surface, that ensures dropping of insects into the lower area, where digestive glands occur as already described. So following the nomenclature of Hooker and the writer, the general external leaf area with its scattered honey-glands forms the "alluring" surface. The inner lid area and the peristome rim with their concentrated honey-glands, form the "attractive" surface, the smooth upper part of the interior that is devoid of glands can well be named the "conducting" surface, while the glistening lower area with its abundant digestive glands, forms the "detentive" and digestive surface.

In greenhouses where ants and cockroaches occur, the captured prey soon accumulate in such pitchers as *N. hybrida*, *N. Hookeriana* or *N. khasiana*, at times also to such an extent that the ammoniacal fumes of the decaying contents cause a brown discoloring of the pitcher-wall. The loose stuffing, therefore, of the pitchers with wadding or moss has been recommended by some growers. But it appears certain that the pitchers are thereby prevented from securing, digesting, and absorbing animal prey that seems to aid in the nutrition of the plant under wild as under cultivated conditions.

Another feature deserves mention here from the cultural and physiological standpoints. The leaves bear an abundance of minute brown peltate hairs, that appear to the naked eye as dark specks. Even though nepenthes be almost wholly deprived for a time of their roots, the plants remain healthy if kept in a moist atmosphere. This and other evidence, that cannot here be cited, suggest that atmospheric moisture may be absorbed directly through the leaf surface, though such a view is contrary to current physiological opinion.

In contrast to the above relations, it has been shown by three observers that several species of insects and also a spider are capable of living, and even, in some cases, of breeding, in the pitcher liquid, while they are able with impunity to ascend and pass out from the pitcher cavity. Their ability to live in the pitcher liquid that digests other insects seems to be due to their having an antagonistic or neutralizing ferment to that in the pitchers.

The size, shape, and color-markings of the pitchers vary greatly. The pitchers of the rare *N. bicalcarata* are usually yellow-green, but may be of a faint brick-red. Projecting downward from the top of its high neck and so overhanging the pitcher-cavity are two strong sharp spines. These have been considered by Burbidge to act as protective spines against the thieving habits of a small lemur (*Tarsius spectrum*) that attempts to rifle the pitchers of their insect prey. When it tries the above it is often caught by the nape of the neck, and tumbled into the pitcher. Equally curious in the same species is the thickened end of the tendril alongside the pitcher, that is always thickened, and in the wild state is drilled by ants which form a home or myrmecarium in the interior.

N. Lowii (Fig. 2462) has large leathery urnshaped pitchers of a greenish yellow hue, each strongly constricted in the middle, and so in outline resembling the finely colored *N. ventricosa* and *N. Burkei*, now in cultivation from the Philippines. *N. Rajah*, found about 6,000 feet on Kinabalu only, attains a height of 5 to 6 feet, but its huge claret-crimson goblet pitchers sit in the moist moss of the ground at the ends of the large dependent leaves which spread out from the stout stem. *N. villosa* and *N. Edwardsiana* are soil-growers or often epiphytes with brilliant crimson pitchers of striking aspect that grow on Kinabalu at 8,000 to 10,000 feet elevation. Two splendid new species, *N. Merrilliana* and *N. truncata*, have recently been described from the Philippines, which suggests that these islands may yet yield other attractive types.

The flowers appear in panicle or simple racemes on

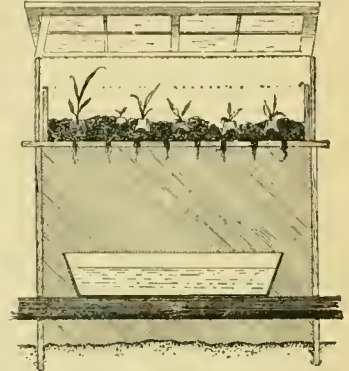
the young wood, and each raceme is opposite a bract-leaf that differs usually in shape and venation from the other foliage-leaves. In greenhouses of the north-eastern states, these inflorescences appear as a rule, from July to October, but only on plants or on shoots that have been allowed to grow long. Thus racemes appear on *N. maxima* (*N. Curtisii*), *N. Hookeriana*, and *N. phyllamphora*

when the shoots are from 5 to 12 feet long. The plants are always dioecious, and so for production of seeds under cultivation a staminate and pistillate plant must be in bloom simultaneously. Failing this, it has been shown experimentally that pollen from a staminate plant can be kept good for days or even weeks, if preserved in tinfoil or in paraffin paper and in a cool place. Taplin adopted this method in order to secure some of his fine hybrids, while *N. Dicksoniana* (page 2128) was got in the Edinburgh Botanic Garden from the seed-parent *N. Rafflesiana*, by applying to it pollen of *N. Veitchii* forwarded from the Veitch establishment in London.

The staminate flowers are produced in dense panicle cymes as in *N. ampullaria*, or in loose simple racemes as in *N. gracilis* and *N. sanguinea*. Each consists of four green, yellowish, red or claret-colored sepals, about $\frac{3}{8}$ by $\frac{1}{4}$ inch in size on the average, and of rather thick texture. The inner surface is closely dotted over with honey-glands that resemble the attractive lid-glands, and which pour out an abundant nectar secretion at the time of blooming. This is often accompanied by a heavy somewhat fetid odor, and the two attractions draw small insects in great numbers to the flowers. Becoming dusted with pollen they carry this to pistillate flowers on other plants. The stamens rarely may be from twenty to twelve in number, commonly they are from ten to eight, or they may be as few as four. The filaments are fused into a short pillar that bears the terminal anthers in a rounded crowded mass. When the latter dehisce the whole appears as a dusty ball of pollen.

The pistillate flowers bear sepals like those of the staminate. The pistil consists of four carpels that are united below to form a four-celled ovary. This incloses many minute elongated ovules, which after fertilization continue to lengthen, and swell up in the middle to form the seeds. The style is either very short and thick, or is practically absent. The stigma is four-lobed to rounded, and forms an expanded thickened mass on top of the short style or of the ovary. It, as well as the sepals, persists during maturation of the fruit. The fruit when ripe is a dry glaucous and shining or a hairy capsule that dehisces loculicidally into four valves. The seeds vary in number, according to the species, from 100 to 500 in a capsule. Each is a light delicate elongated thread-like body, due to great elongation of the loose seed-coat on either end of the central mass. From their extreme lightness they can readily be blown to considerable distances, and this fact, along with the direction of the prevailing monsoon winds, seems to explain the distribution of the species along the western and northwestern sides of the foothills or the mountains where they mainly occur.

The literature of the group has been recently sum-



2461. A simple propagating-frame.

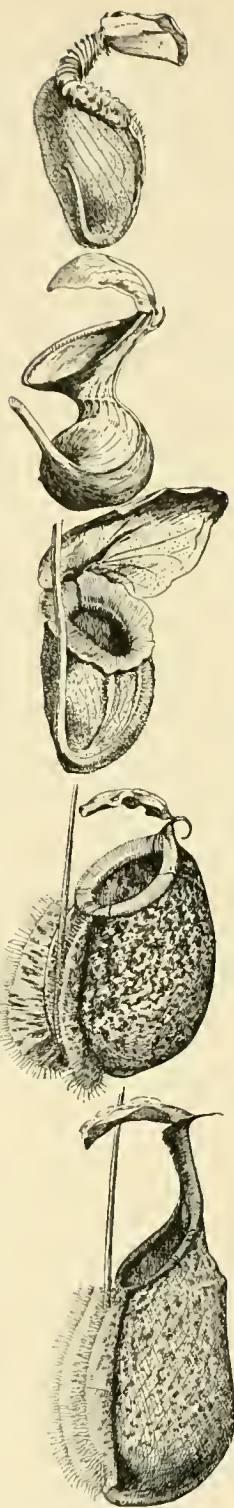
Used by Robert Shore for propagating nepenthes, dracenas and other tropical subjects.

marized by the writer in his monograph published as lft. 36 of Engler's "Pflanzenreich." A general description is there given in English on pp. 2-26, while detailed descriptions of the species and hybrids follow in Latin. An interesting account of the group is given by Veitch and Burbidge in Journ. Roy. Hort. Soc., vol. 21 for 1897, on pp. 226-262.

History and distribution.

We owe the first notice of the group to the French botanist Flacourt. In his "History of the Island of Madagascar" (1658) he described the only native pitcher-plant of that region as *Anramitico*, and inclined to regard the pitcher as a flower or hollow fruit. In 1679 Breyn described the only Ceylon species as *Bandura Zingalensium*, and he justly regarded it as a vegetable wonder. Since that time other forms have been discovered in the Seychelle Islands, in southern China, in northeast India, in the Philippines, the East Indian Islands and in northeast Australia. But the headquarters of the genus extend from the Malay Peninsula—where are ten species—through Borneo and Sumatra, that contain about twenty-four species, to New Guinea and Australia in a southerly and the Philippines in a northerly direction, where are about twenty-six species.

While nearly one-fourth of the species grow in hot reeking swampy situations at or near sea-level in the eastern tropics, the larger number occur in moist ground on the western and northwestern sides of the mountains at elevations of 1,000 to even 10,000 feet. Thus the lone and impressive mountain, Kinabalu in northwestern Borneo, that rises to a height of 13,700 feet, overlooks a tropical shore region that is rich in nepenthes. But, from 3,000 to 10,000 feet, it harbors eight species, some of which are the largest and most gorgeously colored of the genus. The zone of the mountain where the finest are found extends from 6,000 to 10,000 feet and Burbidge has graphically described how this entire belt is almost continuously shrouded in a dense mist, due to moisture precipitation from meeting of the hot lower current of air with the cold currents from the mountain top. This moist dripping climate seems eminently to suit the forms found there, while all of the species flourish best when kept in moist "steamy" surroundings. Repeated attempts were made, from 1750 onward, to introduce and grow a few of the species from Madagascar, Ceylon, India and Borneo. But the type of greenhouse of this earlier period, and the method adopted in their cultivation combined to prevent success. From 1830 to 1860, however, so well had the mode of culture advanced, that seedlings were raised in the Edinburgh, London and Chatsworth gardens, while the Veitch firm that now had collectors like Lobb busy in the native haunts of the genus, imported living plants as well as seeds, both of which they grew successfully. A great impetus was given to the culture of the group when gardeners like Dominy, Taplin, Seden and Court succeeded in crossing some of the species then culti-



2462. Five distinct types of nepenthes.

Beginning from the top they are: *N. villosa*, *N. Lowii*, *N. Rajah*, *N. Hookeriana*, and *N. Rafflesiana*. The first three belong to the famous Kinabalu group. The fourth is the parent of more hybrids than any other kind.

vated, from 1850 to 1870, and in raising hybrids therefrom. These hybrids seemed often to combine good points of both parents, while they, as well as many hybrids since secured, are usually more easy of cultivation, and form a greater showing of the striking pitchers than does either parent. But a new and very lively interest was created in the group after Hooker drew attention to the remarkable structure of the pitchers, and their adaptation to the catching and digestion of insect prey, as set forth in his Belfast address before the British Association in 1874. Collectors like Curtis, Burke, and Burbidge were commissioned by the Veitch firm to secure every available type encountered from Madagascar to Australia. Successful methods of raising, growing and flowering these had been devised; numerous new hybrids appeared in England, America and France from 1875 to 1900, while the scientific interest in the group that was stimulated by the writings of Darwin and Hooker has caused an ever-increasing demand for such plants in every typical collection.

A description of the nepenthes would be very incomplete in such a work as the present, did we not refer again to the history of their hybridization by man, and the resulting production of hothouse types that more than rival in beauty many of the wild species, and which are, as already indicated, more easy of cultivation than are the parent forms.

When Dominy first attempted to cross Nepenthes, few fine forms were in cultivation, *N. Rafflesiana* and *N. Hookeriana* being the best. About 1858 or 1860 he crossed flowers of the former with pollen from what was probably *N. gracilis* from Borneo. The resulting hybrids that were sent out from the Veitch nurseries as *N. Domini* were at once a success under cultivation, and stimulated further experiment with species of the group. Dominy, Seden, Court and Outram continued this in England from 1860 to 1880, while Taplin, a friend of the two latter, extended the work in Such's collection. By the latter period it had been proved that the species of Nepenthes can be hybridized and re-hybridized, at the same time remaining fertile. The varied beauty and easy culture of the hybrids—especially those of Taplin, which were secured and distributed mainly by Williams of London, rendered the group more popular. An added stimulus was given when Court raised *N. Mastersiana* about 1880. But such striking species as *N. Veitchii*, *N. Northiana*, *N. maxima*, (*N. Curtisii*) and *N. sanguinea* were all soon to hand, and so hybridizers like Court, Tivey, Lindsay, and Gautier in Europe, as well as Oliver and Siebrecht in this country, produced novelties in which the "blood" of three to four species was blended. In France, Jarry-Desloges and his gardener have obtained some beautiful and complex hybrids, but they have not as yet been distributed.

The pitchers of some of the above when well grown are magnificent, the plants are in no way more difficult of culture than many of the well-known

orchids, while the climatic conditions of America, when modified by moist stovehouse treatment, seem eminently to favor vigorous growth. They have therefore become familiar objects in many American greenhouse collections during the past decade.

All of the species now in cultivation hybridize readily with each other, and produce abundant as well as good seeds. These should be sown on the surface of a seed-pan that is filled with a finely chopped mixture of sphagnum, pot crocks and charcoal. A bell-jar should cover the pan, and it should then be set in a plate of water to ensure a steamy atmosphere. Germination occurs in two to four weeks. The seedlings should be potted off into thumbs when about a month old, and then changed every two months into larger pots. Well-grown year-old plants begin to show adult characters.

Nepenthes culture. (G. W. Oliver.)

Nepenthes are increased by cuttings and by seeds. The ripened shoots, with four or five leaves attached, make the best cuttings. They may be rooted from December till the end of January, but under proper conditions the operation may be performed at any time during the year. Some of the free-rooting kinds, such as *N. Dominii*, *N. gracilis*, *N. Phyllamphora* and *N. Mastersiana*, may be rooted in sand under a glass with a little moss tied around the base of each cutting. Under this treatment the temperature of the sand should be about 80° F. When the roots show through the moss they should be put in small pots and kept close for a couple of weeks. The most satisfactory method of propagation is to put the base of each cutting through the hole of an inverted 2-inch rose pot, plunging the pot in sphagnum moss in a temperature from 80° to 90° F. (See Fig. 2460.) During the operation of rooting they must be kept in a close propagating-frame and frequently syringed. (See Fig. 2461.) When the roots are about ¾ inch long the cuttings should be potted, using a mixture of finely chopped fibrous peat, moss and sand, with a little finely broken charcoal added. They should be replaced in the moss and kept close until the pots are fairly well filled with roots and then gradually hardened off. All of the kinds do best suspended from the roof of a hothouse, the temperature of which should not fall below 65° F. in winter. The plants may be grown either in orchid-pots or -baskets. In potting or basketing plants from 4-inch pots, large pieces of pot-herd and charcoal should be firmly placed here and there among the potting material, which should consist of rough fibrous peat, moss and sand. The plants should not be allowed to grow as vines unless they are intended to produce seed. When large-sized pitchers are wanted, the ends of the shoots should be nipped out after several leaves have been made and the pitchers are in the process of development; this throws strength into the last-formed leaves and produces very large pitchers. When the plants are in active growth they should be well drenched with water at least once each day and syringed frequently, but care should be taken not to overwater newly potted specimens. They should at all times be shaded from bright sunshine, and when a house is devoted to them, or partly occupied with plants requiring similar treatment, it should be shaded with cloth fixed to rollers. Well-pitchered plants may be taken from the growing house and exhibited in good presentation for a long time in a house under conditions which would be unfavorable for their growth. All of the hybrid forms are of easy culture. *N. Mastersiana*, *N. Dominii*, *N. Outramiana* and *N. Henryana* produce pitchers very freely. The species, as a rule, are not quite so free, but some of them thrive equally as well as the garden forms. *N. Rajah*, *N. Northiana*, *N. sanguinea*, *N. albo-marginata* and *N. bicalcarata* are all more or less difficult to manage, as the conditions under which they grow in their native haunts are sometimes not easily imitated. *N. ampullaria*, *N.*

Rafflesiana, *N. Phyllamphora*, *N. distillatoria* and *N. Kennedyana* are usually seen well furnished with good pitchers.

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KEY TO THE SPECIES.

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|---|--------------------------|
| A. Pitcher-lid small, reflexed..... | 1. <i>ampullaria</i> |
| AA. Pitcher-lid well developed, inflexed over orifice. | |
| B. Lid devoid of keel, spur, or bristles within. | |
| C. Longitudinal veins of lamina 2-4: lvs. sessile. | |
| D. Collar below peristome whitetomentose..... | 2. <i>albomarginata</i> |
| DD. Collar below peristome brownish tomentose. | |
| E. Lvs. decurrent. | |
| F. Peristome broadly expanded, purplish green or purple striped..... | 3. <i>cincta</i> |
| FF. Peristome expanded, green and red-striped..... | 4. <i>Northiana</i> |
| FFF. Peristome expanded, purple..... | 5. <i>mixta</i> |
| EE. Lvs. non-decurrent. | |
| F. Peristome red..... | 6. <i>sanguinea</i> |
| FF. Peristome crimson to purple..... | 7. <i>Mastersiana</i> |
| CC. Longitudinal veins of lamina 2-4: lvs. stalked. | |
| D. Peristome deeply ridged; pitchers pyriform..... | 8. <i>villosa</i> |
| DD. Peristome deeply ridged; pitchers elongate-tubular.... | 9. <i>Edwardsiana</i> |
| CCC. Longitudinal veins of lamina 5-6: lvs. sessile, non-decurrent. | |
| D. Pitchers strongly constricted in middle, mouth transverse.... | 10. <i>ventricosa</i> |
| DD. Pitchers strongly constricted in middle, mouth oblique..... | 11. <i>Burkei</i> |
| DDD. Pitchers large, oval..... | 12. <i>Merrilliana</i> |
| CCCC. Longitudinal veins of lamina 5-6: lvs. sessile, decurrent. | |
| D. St. slender trigonous; peristome narrow-oblique..... | 13. <i>gracilis</i> |
| DD. St. stout cylindric; peristome rounded, oblique..... | 14. <i>khasiana</i> |
| DDD. St. stout cylindric; peristome elevated into short neck..... | 15. <i>Sedenii</i> |
| CCCCC. Longitudinal veins of lamina 5-6: lvs. petiolate. | |
| D. Pitchers green, reddish or slightly purple-spotted. | |
| E. Lvs. herbaceous; peristome green, cylindric..... | 16. <i>distillatoria</i> |
| EE. Lvs. coriaceous; peristome green, cylindric..... | 17. <i>hybrida</i> |
| EEE. Lvs. coriaceous; peristome expanded..... | 18. <i>cylindrica</i> |
| DD. Pitchers richly green and purple-blotched; peristome pale green, oblique. | |

- E. Color of pitchers throughout purple-blotched 19. *Dormanniana*
- EE. Color of pitchers below purple-red, above purple-blotched 20. *paradisæ*
- DDD. Pitchers green and purple-blotched; peristome oblique, green and purple-striped.
- E. Color of pitchers red-purple with pale green spots 21. *atrosanguinea*
- EE. Color of pitchers green with heavy purple marblings.
- F. Pitcher-wings narrowing from below upward, fringed 22. *Dominii*
- FF. Pitcher-wings broad, uniform 23. *excelsior*
- FFF. Pitcher-wings broad, doubly fringed 24. *Hookeriana*
- FFFF. Pitcher-wings of various forms.
- G. Lf.-margins ciliate-toothed 25. *Lawrenciana*
- GG. Lf.-margins hairy: pitchers yellow-green with abundant red spots 26. *Outramiana*
- GGG. Lf.-margins plain: pitchers yellow-red to red with fine crimson-purple spots 27. *Williamsii*
- DDDD. Pitchers like DDD, but peristome more or less elevated behind into a neck, or widely expanded.
- E. Peristome elevated into a slight neck behind 28. *Chelsonii*
- EE. Peristome elevated into a high neck behind 29. *intermedia*
- EEE. Peristome elevated into a high widening neck 30. *Rafflesiana*
- EEEE. Peristome oblique, widely expanded laterally 31. *Dicksoniana*
- EEEE. Peristome expanded, elevated into a neck behind 32. *edinensis*
- CCCCC. Longitudinal veins of lamina 7-12: lvs. stalked.
- D. Lvs. non-decurrent.
- E. Pitcher-wings narrow or nerved 33. *Phyllamphora*
- EE. Pitcher-wings prominent 34. *coccinea*
- DD. Lvs. slightly decurrent.
- E. St. finally glabrous: pitcher-wings expanded 35. *Kennedyana*
- EE. St. hairy 36. *Rowanæ*
- DDD. Lvs. decurrent.
- E. The lvs. greenish red or red below 37. *madagascariensis*
- EE. The lvs. of a peculiar dark green; two strong peristome spines below lid 38. *bicalcarata*
- BB. Lid with keel, spur or bristles within.
- C. The lid with basal keel only.
- D. Lvs. hairy.
- E. Color of pitchers yellow or greenish red 39. *Veitchii*
- EE. Color of pitchers yellowish green with purple spots; lamina usually pettute 43. *Dyeriana*
- DD. Lvs. glabrous (except margin in *N. Wittei*).
- E. Pitchers green, purple-spotted 40. *alata*
- EE. Pitchers crimson-purple 41. *Rajah*
- EEE. Pitchers brownish red, purple-spotted 42. *nobilis*
- EEEE. Pitchers tubular, pale green 44. *Wittei*
- EEEE. Pitchers crimson: lvs. truncate at both ends 45. *truncata*
- CC. The lid with median keel only 46. *stenophylla*
- CCC. The lid with basal keel and sub-apical spur.
- D. St. glabrous 47. *maxima*
- DD. St. hairy 48. *Tiveyi*
- CCCC. The lid with apical spur only 49. *Balfouriana*

- CCCCC. The lid with long rough bristle hairs within 50. *Lowii*
- CCCCCC. The lid with shining bristle hairs within 51. *Macfarlanei*

1. *ampullaria*, Jack. Bright green, st. and lvs. when young rusty-hairy; pitchers small, green or with few purple spots; peristome broad, obliquely inclined inward; lid small, reflexed. Malaya, Sumatra, Borneo, New Guinea. B.M. 5109. I.H. 24:272. F.S. 22:2325. —An interesting type, easy of growth, and often producing clusters of small pitchers.

2. *álbo-marginata*, Lobb. St. and lvs. white-tomentose when young; pitchers tubular, dull green with abundant purple blotches or areolations; peristome bounded below externally by a white collar. Malaya, Sumatra, Borneo. G.C. 1872:541, 542. F.S. 22:2343, 2344. —Grows in stiff moist clay in native home (Burbidge), but difficult under cult. A variety with deep purple pitchers is grown as *N. albocincta* var. *rúbra*.



2463. Three old-time nepenthes.

Much confused in collections and difficult to distinguish: *N. phyllamphora* above, *N. khasiana* in the middle, *N. distillatoria* below.

3. *cincta*, Mast. (*N. Northiana* × *N. álbo-marginata*). Lvs. thick, deeply amplexicaul, decurrent; pitchers 3-10 x 1-3 in., dimorphic, lower ventricose in inferior, cylindric in superior half, upper cylindric to funnel-shaped, green flushed with red and richly purple-blotched; peristome bounded below by brownish white felted collar. G.C. II. 21:576. R.B. 21, pp. 268, 269. Gn. W. 4:101. —A vigorous and striking natural hybrid got from seeds collected by Burke. In all characters nearly intermediate between parents.

4. *Northiana*, Hook. f. (*N. spúria*, Beck). Robust, bright green: lvs. amplexicaul, deeply decurrent, sessile, thick herbaceous, apex pettate; pitchers 3-14 x 1-4 in., dimorphic; lower sub-ovate, pale green with purple spots, upper funnel-shaped with recurved base, richly purple-spotted; peristome widely expanded. Borneo. G.C. II. 16:717. Gn. 23:492 (as *N. Morganiae*). J.H.S. 21:236. Gn.W. 4:105. J.H. III. 44:127. —Difficult of growth but with lovely large pitchers. It has been used as parent for some fine hybrids.

5. *míxta*, Mast. (*N. Northiana* × *N. máxima*). Lvs. amplexicaul, deeply decurrent, petiolate, elliptic with pettate apex: pitchers 3-12 x 1½-3½ in., ventricose-cylindric, yellow-green and sparsely purple-spotted below, abundantly flecked with large spots above; wings narrow, or absent below, expanded and fringed higher; peristome rich purple. G.C. III. 13:47. G.Z. 20:145.

G.M. 36:754. F.E. 16:447. G.W. 10:527; 14:293. —One of Tivey's best hybrids that makes a strong growth, flowers readily, and has been a parent for some even finer hybrids.

6. *sanguinea*, Lindl. Lvs. sessile, deeply amplexicaul, thick, herbaceous, oblong-lanceolate; pitchers 3-10 x 2-3 in., ventricose-cylindric to cylindric, bright red to reddish green, wings expanded fringed, or narrow plain; peristome laterally expanded. G.C. 1849:580; 1872:541. F.S. 22:2343. F.M. 1874:128. Gn.W. 24:

504.—Sent about 1849 from Malaya by Lobb to England, but cult. difficult. It yielded the hybrid *N. Mastersiana*, but is now rare in cult.

7. *Mastersiana*, Veitch (*N. sanguinea* × *N. khasiana*). Lvs. sessile, slightly decurrent, glabrous, shining; pitchers 5–15 × 1½–3 in., crimson-green with purple spots to uniformly deep crimson; wings fringed or rudimentary; peristome crimson-green to crimson. G.C. 21:248, 249. Gn. 23:492. G.W. 9:285. I.H. 33:618. J.H.S. 21:237.—A beautiful and easily grown hybrid of Court, but which varies greatly in pitcher-coloring.

8. *villôsa*, Hook. f. Fig. 2462. This is distinct from all other species here described by its rim, which is composed of distant disks that are circular except for teeth which project down into the pitcher.

9. *Edwardsiana*, Hook. f. This and the last are probably the most striking species of the genus. Both are figured in color by Spencer St. John in *Life in Forests of Far East*, also by Hooker in *Trans. Linn. Soc.* 22:69, 70. The former has a short urn-shaped, this a long cylindric pitcher. Neither has as yet been cult. Borneo.

10. *ventricôsa*, Blanco. Terrestrial or epiphytic: lvs. thick, aggregate round st., sessile, shortly decurrent, linear to lanceolate: pitchers in aspect as in *N. Burkei* but mouth elliptic in outline and transverse; lid with 3 to 4 pairs of veins. G.C. III. 23:379. Gn. 74, p. 647. G.M. 44:691. J.H. III. 43:486.—Near to though distinct from *N. Burkei*, but both are native to the Philippines. It flourishes fairly well under cool moist treatment.

11. *Burkei*, Mast. Lvs. sessile, slightly decurrent, aggregate round st., linear-lanceolate, slightly contracted above insertion: pitchers 3–6 × 1–2½ in., dimorphic, lower cylindric-ventricose, upper constricted in middle, ventricose below, widening above; mouth ovate-oblique, wings absent, surface pale green or with few purple blotches below, heavily blotched above; lid equal to or larger than mouth, with 6–7 pairs of veins. Mindoro in Philippine Isls. Var. *excellens*, Veitch, has short wide pitchers richly purple-tinted with dark purple blotches. G.C. III. 6:493; 8:184, desc. Gn. W. 7:137; 11:153.—This is a species that pitchers abundantly if kept in cult.

12. *Merrilliana*, Macfarlane. A Philippine species with large crimson-green pitchers, that when intro. may prove valuable for hybridization. Recently described by the author in *Bot. Contrib. Univ. Penn.* 3:207, pl. 1.

13. *gracilis*, Korthals. Plant slender with green to dull red st.: lvs. sessile, decurrent, elliptic, glabrous, veins 5–7: pitchers 2–4 × ½–1 in., pale green with delicate purple flecks or spots, lower cylindric-ventricose with fringed wings, upper cylindric with narrow wings or ridges; peristome narrow green. G.C. 1872:542, desc.—A weedy species of easy cult., but shy in producing its delicate pitchers. It grows in marshy areas in Malaya, Borneo and Sumatra.

14. *khasiana*, Hook. f. Fig. 2463. Lvs. sessile, lanceolate: pitchers 3–7 × 1–1½ in., elongate, tubular, green to reddish green with narrow fringed wings; peristome green, cylindric; lid oval, green outside, reddish green inside. B.M. 2629 (as *N. Phyllamphora*); 2798 (as *N. distillatoria*).—Early intro. into cult. from the Khasia Mts. of E. Hindostan, but now rarely seen. It forms shoots 30–40 ft. long with abundant long green pitchers.

15. *Sedenii*, Mast. (*N. ?* × *N. khasiana*). Lvs. half-amplexicaul, decurrent, lanceolate, glabrous: pitchers 3–5 × 1–2 in., ventricose below, constricted in middle, cylindric above; wings fringed; peristome cylindric, elevated somewhat into a neck behind. G.C. 1872:542, desc. F.W. 1870:321. F. 1872:54. J.H.S. 21:237.—A

hybrid of Seden's that is often and well grown in American greenhouses.

16. *distillatoria*, Linn. (*N. indica*, Poir. *N. zeylanica*, Raf. *N. hirsuta* var. *glabrescens*, Smith. *N. rubra*, Nichols. *N. zeylanica* var. *rubra*, Beek. *N. speciosa*, Hort.). Fig. 2463. Plant bright green, rather slender: lvs. petiolate, half-amplexicaul, glabrous, elliptic-elongate: pitchers 3–5 × 1–1½ in., dimorphic, pale green to dull crimson, lower ventricose below, tubular above; wings wide, fringed, narrowed from below up; mouth nearly transverse; upper cylindric, wings rudimentary, mouth oblique with short posterior neck; peristome cylindric green. P.M. 4:1. L.B.C. 11:1017.—A somewhat unattractive species from Ceylon, that has been a parent of several hybrids.

17. *hybrida*, Mast. (*N. khasiana* × *N. gracilis?*). Lvs. amplexicaul, decurrent, semi-petiolate, elongate-lanceolate: pitchers 3–5 × ¾–1 in., cylindric, slightly constricted in middle, green or somewhat purple-spotted (var. *maculata*); wings shallow ciliate. G.C. 1872:542, desc. J.H.S. 21:1897:238.—A hardy freely pitchering though rather unattractive type that usually catches abundant insect prey in greenhouses. Raised by Dominy about 1863, and sent out by Veitch in 1866.

18. *cylindrica*, Veitch (*N. distillatoria* × *N. Veitchii*). St. ascending: lvs. obovate or oblanceolate with reddish midrib; pitchers 5–7 × 1–2 in., ovate-elongate or sub-cylindric, pale green with few small purple spots; wings narrow, interrupted below, fringed above; peristome expanded, yellow-green. G.C. III. 2:521.—A rather unattractive hybrid that is now rare in cult.

19. *Dormanniana*, Williams (? *N. Phyllamphora* × *N. Sedenii*). Lvs. elliptic-lanceolate, margin finely ciliate, veins 5–6: pitchers 4–6 × 2–2½ in., cylindric-ventricose, green and purple-blotched; wings fringed or dentate, narrowed upward; peristome pale green. G.C. II. 17:525. Gn. 27:496.—A pretty hybrid of doubtful parentage that was raised by Taplin and sent out by Williams.

20. *paradisæ*, Hort. Parents probably similar to *N. Laurenciana*, but pitchers richly purple-red below, yellow-spotted above.—Sent out by Williams in 1833.

21. *atrosanguinea*, Mast. (? *N. distillatoria* × *N. Sedenii*). Pitchers ventricose below, cylindric above, reddish purple with pale green mottlings; wings fringed wide below, gradually narrowed above; peristome cylindric, oblique, pale green and purple-striped. G.C. II. 17:827.—A Taplin hybrid that grows readily and pitchers freely if kept out back.

22. *Dominii*, Veitch (*N. Rafflesiæ* × ? Bornean sp. probably *N. gracilis*). St. dark red: lvs. amplexicaul, decurrent, petiolate, lanceolate: pitchers 3–5 × 1–2 in., ventricose below, contracted toward mouth, mottled green and dark purple; wings narrowing from below upward, fringed; peristome uniform, elevated into a neck behind. J.H.S. 21:238.—This, the first artificial hybrid, was raised by Dominy about 1860, and is still a favorite of easy cult.

23. *excelsior*, Williams (*N. Rafflesiæ* × *N. Hookeriæ*). St. and lvs. at first densely tomentose-pubescent, at length glabrous: lvs. petiolate elliptic: pitchers cylindric-ventricose, pale green with deep purple spots and blotches; wings wide, fringed; peristome cylindric, elevated into a neck behind.—Amongst the best of Taplin's hybrids, as the pitchers are freely produced and are sharply marked, while the plant grows well and prop. readily. *N. amabilis* and *N. Amesiana* have the same parentage and are nearly related in aspect.

24. *Hookeriæ*, Lindl. (*N. Loddigesii*, Baxter. *N. Hookeri*, Alphand). Fig. 2462. Plants strong, young parts covered with brownish white pubescence: lvs. amplexicaul, petiolate, elliptic-lanceolate, veins 5 with

radiating nerves: pitchers 2-5 x 1-3 in., dimorphic; lower subglobose, pale green with extensive purple blotchings; wings ample, doubly fringed; upper funnel-shaped wings narrow not fringed, mouth oblique elevated into a neck behind. G.C. II. 16:813. I.H. 41, p. 145. G.W. 2:151. A.G. 18:877.—A vigorous, attractive and amenable plant that bears abundant pitchers of rich coloring. The writer regards it as a natural hybrid from Borneo between *N. ampullaria* and *N. Rafflesiana*, as it blends parental characters of these.



2464. How the pitchers change their shape.

The earliest and best are mug-shaped ones; the topmost pitchers of old and tall plants are cylindrical. *N. Rafflesiana*, both from same plant. Adapted from B.M. 4285.

Gn. 23:492. J.H.S. 21:237, 239. G.Z. 23:121.—A very commendable hybrid of Seden's raising. Var. *excellentis* is the same as *N. edinensis* (No. 32).

29. *intermedia*, Veitch (? *N. hirsuta* or *N. gracilis* × *N. Rafflesiana*). Lvs. petiolate, lanceolate: pitchers 5-8 x 2-3 in., ovate, slightly ventricose below, green and abundantly small purple-spotted; wings conspicuous fringed; peristome cylindric, greatly elevated into a neck behind, pale green with purple stripes. G.C. II. 17:179. F. 1875, p. 257. Gn. II, p. 429. G.Z. 21:265. J.H.S. 21:237, 238.—A pretty, common, and easily grown hybrid.

30. *Rafflesiana*, Jack (*N. Sanderiana*, Burridge). Figs. 2462, 2464. Lvs. long-petioled oval to lanceolate, like the st. white tomentose when young, at length glabrous: pitchers 3-7 x 2-4 in., dimorphic, lower urn-shaped, upper funnel-shaped, pale green with varied, purple spots and blotches; peristome uniform, much elevated into high neck behind; pitcher within with triangular glaucous conducting and lower shining detentive area. B.M. 4285. F.S. 3:213, 214; 16:1698; 22:2343. F. 1850:77; 1872, p. 221. G.C. 1872:1164. F.S.R. 2:113, desc.; 3:280. G.Z. 30:265.—Native from Malacca to Borneo and Sumatra, it was early brought

to Eu., and is a parent of many hybrids. *N. nigro-purpurea*, Mast. (G.C. II. 18:429) is a dark purple form with almost white spots.

31. *Dicksoniana*, Lindsay (*N. Rafflesiana* × *N. Veitchii*). Lvs. petiolate, deeply amplexicaul, blade elliptic-obovate, sparsely hairy beneath: pitchers 4-8 x 2-3 in., cylindric-ventricose, somewhat villous, pale green with abundant purple blotchings; peristome oblique, wide, pale green with purple stripes; lid oblong. G.C. III. 4:543, desc. Gt. 38, p. 466. Tr. Bot. Soc. Edin. 18:236. Gn.W. 6:25.—A beautiful hybrid that was raised by Lindsay in the Edinburgh Garden, but which is subject to lf.-spotting and scale.

32. *edinensis*, Lindsay (*N. Rafflesiana* × *N. Chélonii*). Lvs. petiolate, lanceolate: pitchers 3-6 x 2-3 in., ovate, slightly ventricose, yellow-green with dark purple spots; wings expanded, widest below, fringed; peristome wide, subcylindric, slightly elevated into neck behind. A.F. 7:381.—Raised in the Edinburgh Garden by Lindsay, and a pretty hybrid when well grown, but rather difficult of treatment.

33. *Phyllamphora*, Willd. (*N. macrostachya*, Blume. *N. fimbriata*, Blume. *N. O'Brieniana*, Rod. *Phyllamphora mirabilis*, Lour.). Fig. 2463. Lvs. petiolate, light green, herbaceous, glabrous, veins 6-10 pairs, margin dentate-ciliate: pitchers 3-6 x 1-1½ in., subcylindric, slightly inflated in lower half, pale green to red-green or red (*N. O'Brieniana*); wings narrow or as cords; peristome cylindric, transverse, green rarely red; lid orbicular. B.M. 8067. I.H. 37:116. Native from S. China to Borneo, Sumatra and N. Guinea.—It was first cult. nearly a century ago, and has been parent of several hybrids. It varies in shape and color in different localities.

34. *coccinea*, Mast. (*N. Hookeriana* × *N. Phyllamphora*). This has probably the same parents as *N. Lawrenciana* and *N. Patersonii* and mainly differs in the more generally purple-red surface with yellow-green marblings and spots. G.C. II. 18:169. I.H. 41, p. 143.—It combines very fairly the good points of both parents in being an easily grown, abundantly pitched and attractively colored type.

35. *Kennedyana*, F. Muell. An Australian species very near to *N. Phyllamphora* that was grown from 1880 to 1890 and now is rare or lost to cult. G.C. II. 17:257.

36. *Röwanæ*, F. M. Bailey. Plant stout, erect: pitchers large, dull crimson-green to crimson; peristome cylindric in front, expanded widely behind. G.C. III. 22:338, desc. J.H.S. 22:192.—An Australian species, first found and illustrated by Mrs. Ellis Rowan, and which may yet be a well-known horticultural form.

37. *madagascariensis*, Poir. The most outlying species of the genus and native to Madagascar. It forms low upright plants 2-3 ft. high, and bears deep crimson pitchers. It has been intro. repeatedly into French and English stovehouses, but seems to die off rather quickly. G.C. II. 16:685.

38. *bicalcarata*, Hook. f. (*N. Diak*, Moore). Plant tall, stout, yellow-green: lvs. petiolate, large, with 8-14 veins: pitchers goblet-shaped, yellow to brownish or reddish green, rarely almost brick-red; wings conspicuous; peristome with 2 long sharp descending spines behind: fls. in long loose panicles. N. W. Borneo. G.C. II. 13:201. I.H. 28:408. Gn. 33, p. 29.—A remarkable species, but very difficult in cult.

39. *Veitchii*, Hook. f. Fig. 2465. St. creeping, hairy, epiphytic: lvs. alternate, petiolate, decurrent, elliptic to obovate: pitchers 4-8 x 1½-3 in., yellow-green to reddish hairy; wings expanded and fringed or rudimentary; peristome pale green or red-green, widely expanded behind (Fig. 2465); lid yellow-green with strong basal keel within. B.M. 5080 (as *N. villosa*, in error). G.C.

1872:542, desc.; II. 16:781; 18:808 (as *N. sanguinea*, in error); III. 20:239, desc. F.M. 1877:265. I.H. 23:192.—A unique species from Borneo that has been a parent for many of the best hybrids.

40. *alata*, Blanco. Plants terrestrial or epiphytic; st. trigonous; lvs. amplexicaul, petiolate, elliptic-lanceolate, nerves 3, rarely 4 pairs; pitchers somewhat dimorphic, cylindric-ventricose to cylindric, finely stellate-pubescent; wings rudimentary below, widening and fringed above; peristome oblique, slightly elevated into a neck behind; lid broadly cordate with internal basal keel. Fl. Filip. ed. 3:III 214; IV. 173.—As yet not intro. from the Philippine Isls., but of bright color and graceful shape; deserving therefore of attention.

41. *Rajah*, Hook. f. Fig. 2462. St. upright, stout; lvs. large, thick, coriaceous; mature pitchers 5-9 x 3-5 in., red-purple or green-purple; wings widening from below upward, fringed; peristome widely expanded with undulate margin, deep crimson; lid large cordate. Tr. Linn. Soc. 22:421. G.C. II. 16:493. Gn. 22, p. 122. F. 1883:167. B.M. 8017.—A magnificent species from Kinabalu, Borneo, that is difficult under cult. Moore, of Glasnevin, has succeeded well by growing it in a "filmy-fern atmosphere."

42. *nobilis*, Veitch (*N. sanguinea* x *N. maxima* var. *superba*). Lvs. slightly stalked, thick, herbaceous, elliptic-oblong, peltate at apex; pitchers 6-9 x 1½-2 in., cylindric, brownish red with scattered purple blotches; wings expanded ciliate; peristome oblique crimson-purple, outer margin wavy; lid with shallow basal crest. G.C. III. 45:25.—A striking hybrid with richly mottled interior to the pitchers.

43. *Dyeriana*, Macfarlane (*N. mixta* x *N. Dicksoniana*). Lvs. petiolate amplexicaul, decurrent, oval to elliptic-obovate, apex often peltate; pitchers 5-12 x 2-3½ in., cylindric-ventricose, yellowish green with abundant purple spots and blotches; wings wide, long-ciliate; peristome widely expanded and elongated somewhat into a neck behind; lid with prominent external keel. G.C. III. 28:257; 38:325, desc.—A splendid hybrid that grows readily, and forms large pitchers. It was raised by Tivey and sent out by the Veitch firm in 1900.

44. *Wittei*, Veitch (*N. stenophylla* x *N. maxima*). Lvs. deeply amplexicaul, petiolate, with expanded winged base, elliptic-obovate with rounded or peltate apex; pitchers 3-7 x ½-1½ in., tubular with brown pubescent girdle below peristome, pale green with red or purple areolations; wings intermediate between those of parents; lid with basal median-keel within. J.H.S. 21:238.—Raised by M. Witte, curator of Leiden Garden, it is very nearly between the two parents.

45. *truncata*, Macfarlane. Lvs. large, petiolate, lamina truncate at base and apex; pitchers large, urceolate, crimson; wing narrow or cord-like; peristome widely expanded, undulate without; lid small, keeled at base within. Bot. Contrib. Univ. Penn. 3:207, pl. 2.—A remarkable species collected by W. J. Hutchinson during 1907 in Mindanao, Philippine Isls.

46. *stenophylla*, Mast. Lvs. petiolate, elliptic-lanceolate, lf.-veins 3; pitchers 3-5 x ½-1 in., tubular, slightly ventricose below, pale green with abundant purple spots and areoles; wings nerve-like below, slightly expanded in middle, fringed toward mouth; lid with internal basal keel. G.C. III. 8:240, desc.; 11:401.—A neat, graceful and richly colored species from Borneo, but hard to grow. It is now rare in cult., but its hybrid *N. Wittei* is fairly easily grown.

47. *maxima*, Reinw. (*N. celibica*, Hook. f. *N. Curtisii*, Mast. *N. fallax*, G. Beck). Lvs. amplexicaul, petiolate, elliptic with brown ciliate margin; pitchers dimorphic to trimorphic, lower ventricose below, cylindric above; wings expanded, fringed; middle pitchers cylindric with narrow unfringed wings; upper funnel-

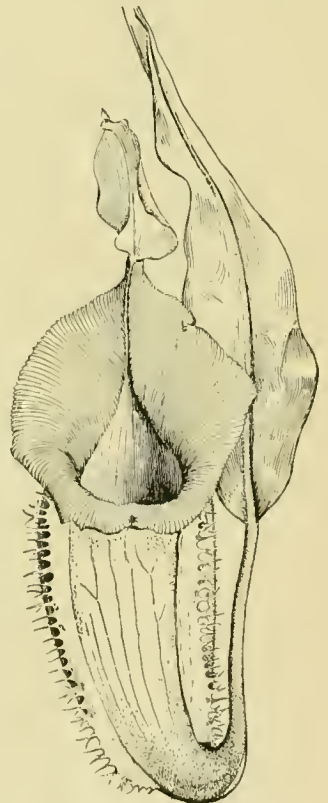
shaped with wings reduced to cords; all pale green, heavily blotched or overlaid by purple areoles; peristome cylindric in front, expanded and undulate posteriorly, green-purple to dark purple; lid cordate with basal crest and subapical spur within. G.C. III. 2:689; 6:661. B.M. 7138. I.H. 35:59.—A richly colored species that is native to Celebes, Borneo, and N. Guinea, and that was intro. by Curtis from Borneo. It thrives well, flowers freely, and has been a parent of some striking hybrids.

48. *Tiveyi*, Mast. (*N. maxima* x *N. Veitchii*). Lvs. amplexicaul, decurrent petiolate, elliptic-obovate, apex peltate; pitchers 3-10 x 1½-3 in., cylindric, yellow-green with many large irregular purple blotches; wings imperfect below, expanded and fringed above; peristome widely expanded and undulate laterally, elevated into a neck behind; lid inside with basal keel and subapical spur. G.C. III. 22:200, 201. G.M. 40:599. J.H.S. 21:238.—A large strong and cultivable hybrid that was raised by Tivey. It promises to become a favorite type.

49. *Balfouriana*, Mast. (*N. mixta* x *N. Mastersiana*). Pitchers 5-10 x 2-4 in., cylindric-ventricose, green with few large purple spots over surface or mainly toward peristome; wings large, fringed; peristome expanded, purple and green-striped; lid with subapical spur. G.C. III. 26:91.—A striking and fairly easily grown hybrid that was raised by Tivey, and which blends the parental characters of *N. Northiana*, *N. maxima* (*N. Curtisii*), *N. sanguinea* and *N. khasiana*.

50. *Löwii*, Hook. f. Fig. 2462. A striking species from Kinabalu that bears large yellow-green leathery pitchers, shaped as in Fig. 2462. It has not been intro. into cult.

51. *Macfarlanei*, Hemsl. A Malayan species with oval or funnel-shaped pitchers that are green, with extensive deep claret areolations. The lid bears long hirsute bristles within.—Not yet in cult., but a promising species for hybridization.



2465. *Nepenthes Veitchii*, notable for its wide rim.

N. Allittii=*N. Northiana* x *N. maxima*.—*N. atropurpurea*=*N. sanguinea* x *N. maxima* var. *superba*.—*N. Boisiana*=*N. Tiveyi* x *N. Morganii*.—*N. compacta*=*N. Hookeriana* x *N. Phyllamphora*.—*N. Courtii*=*N. (?)* x *N. Dominii*. A hybrid of Court that is rare in cult. G.C. II. 16:845.—*N. Deslogei*=*N. Tiveyi* x *N. mixta*.—*N. excelsa*=*N. Veitchii* x *N. sanguinea*.—*N. Fournieri*=*N. Northiana* x *N. mixta*.—*N. Gámerii*=*N. Tiveyi* x *N. mixta*.—*N. Gaudieri*=*N. Northiana* x *N. mixta*.—*N. grandis*=*N. maxima* var. *superba* x *N. Northiana* var. *pulehra*.—*N. Henryana*=*N. Sedenii* x *N. Hookeriana*. I. II. 4:15; 29:460. G. W. 14:297.—*N. longicaudata*=*N. maxima* var. *superba* x *N. Northiana* var. *pulehra*.—*N. Mercieri*=*N. Northiana* x *N. mixta*.—*N. Pátersani*=*N. Paradisii*.—*N. Paulii*, Hort.=?—*N. picturata*=*N. Dyeriana*. G. M. 46:677. F.S.R. 2, p. 69.—*N. Rutchiffiana*=*N. Hookeriana* x *N. Phyllamphora*. G.Z. 26:241.—*N. remiliensis*=*N. maxima* var. *superba* x *N. Northiana*

var. *pulehra*.—*N. robusta*=*N. Hookeriana* × *N. Phyllamphora*. G. C. 11, 14 41. F. 1880, p. 156.—*N. rufescens*=*N. distillatoria* var. *rubra* × *N. Courtii*. A rare and rather unattractive hybrid. G. C. 111, 4: 669.—*N. Siebrechtiana*=*N. Phyllamphora* × *N. Sedenii*.—*N. Simonii*=*N. Northiana* × *N. mixta*.—*N. splendida*=*N. Hookeriana* × *N. Phyllamphora*.—*N. Steudarti*=*N. Hookeriana* × *N. Phyllamphora*. F. 1879, p. 157.—*N. superba*=*N. Sedenii* × *N. Hookeriana*. G. Z. 25: 145.—*N. Vallières*=*N. Tiveyi* × *N. mixta*.—*N. Wrigleyana*=*N. Hookeriana* × *N. Phyllamphora*. G. C. 11, 17: 143.

J. M. MACFARLANE.

NÉPETA /Latin, perhaps from Nepete, an Etrurian city). *Labiata*. This group includes catnip, ground ivy and some other hardy perennial herbs of the easiest culture.

Perennial or annual herbs, tall and erect, or dwarf and more or less trailing: lvs. dentate or incised, the



2466. Leaf of catnip.



2457. Catnip.—
Nepeta Cataria.
(×3)

floral ones like the rest or reduced to bracts: whorls of fls. crowded in a dense spike, or in a loose cyme, rarely few-fl'd. and axillary; fls. blue or white, seldom yellow; calyx 15-nerved; corolla somewhat 2-lipped; upper lip straight or erect; lower lip spreading, 3-lobed, with the large center lobe concave; perfect stamens 4, in pairs, the 2 shorter ones in front; ovary 4-parted. The genus is placed near *Lopanthus* and *Dracocephalum*, and is characterized as follows: calyx tubular, the mouth straight or oblique, 5-toothed; stamens usually parallel, ascending; anther-cells divergent or divaricate.—About 150 species, mostly in the northern hemisphere outside the Old World tropics.

Catnip is a familiar weed near dwellings and barns. Cats are fond of it, and catnip tea is a pungent memory with those who have survived the era of homely simples. The seeds of catnip are still offered. Ground ivy (*N. hederacea*) also grows wild in America, and a form of it with variegated foliage is cultivated for edging flower-beds or covering banks and stones. It is hardy in light well-drained soils, but sometimes winter-kills in moist soils. It is also used in vases and baskets. *N. hederacea* is a perennial creeping plant of easy culture in any loose, rich, fairly moist soil in either shade or full sunlight, but to be luxuriant in the open it should have a moist rootage. It is a very rapid grower, and is therefore often troublesome when planted with other low-growing plants. It is very useful as a ground-covering in shrubbery borders and shady places generally, particularly where it can hang over curbs or edgings or where a good sward cannot be secured.

A. Blossoms small, rather inconspicuous.

B. Color of fls. white or nearly so.

Catària, Linn. CATNIP or CATNEP. CATMINT. FIGS. 2466, 2467. Perennial, densely downy, pale green; st. rather stout, tall and erect: lvs. heart-shaped, green above, whitish below, crenate, stalked: corolla nearly white, or pale purple, dark-dotted. Blooms from July–Nov. Eu., Orient.

BB. Color of fls. blue.

hederacea, Trev. (*N. Glechoma*, Benth. *Glechoma hederacea*, Linn.). GROUND IVY. GILL-OVER-THE-GROUND. FIELD BALM. Fig. 2468. Perennial, hairy: creeping sts. leafy, making a dense mat: lvs. roundish, more deeply notched at the base than catnip, and green on both sides, the floral ones like the others, not reduced to bracts as in the other kinds here described; lower petioles longer than the lvs.: whorls axillary, few-fl'd., blue. Nat. from Eu., Asia. C.L.A. 23:57. B.B. 3:87. G.W. 9, pp. 244, 245; 13, p. 558—Other old vernacular names are alehoof, cat's-foot, gill, gill-ale, gill-go-by-the-ground, hayhofs, haymaids, hove, tunhoof, creeping charlie, robin-run-away, gill-runover, crow-vituals, wild snake-root, hedge-maids. March–June.—The green-lyd. form is less cult. than var. *variegata*, Hort. (*N. hederacea*, Trev., var. *variegata*, Hort.).

AA. Blossoms larger, showy, blue.

B. Lvs. not notched at the base.

macrantha, Fisch. Erect plant, branching, nearly glabrous: lvs. short-stalked, ovate-lanceolate, green on both sides: cymes peduncled, few-fl'd.; fls. 1 in. long; bracts minute. Altai. B.M. 2185 (as *Dracocephalum sibiricum*).—Prop. by division of underground sts.

Wilsonii, Duthie. Allied to *N. macrantha*: herbaceous perennial, 2–2½ ft. high: lvs. shortly stalked, the upper subsessile, ovate-oblong, 2½–3¼ in. long, obtuse, crenate: fls. in distant whorls, short-stalked; corolla violet, about 1 in. long, with a slender tube white at the base, curved and enlarged above. W. China.

BB. Lvs. notched at base.

c. Fls. pedicelled.

grandiflora, Bieb. (*N. melissifolia*, Pers.). Height 20 in. or more: plant nearly glabrous, green: st. erect and branching: lvs. short-petioled, large, long, heart-shaped, crenate-margined: corolla with upper segm. awl-shaped, much shorter than the violet, hairy lower segm.; calyx-lobes long pointed; fls. beautiful blue. Known in gardens as *N. argentea*, Hort., *N. grandis*, Hort., *N. incana*, Hort., *N. teucrioides*, Hort. Summer. Caucasus.



2468. *Nepeta hederacea* about
a tree trunk.

betonicaefolia, C. A. Mey. Upper lvs. green on both sides, notched at base, and cordate; bracts a half shorter than the calyx; fls. pedicelled in dense heads; racemes simple, short; calyx elongate, villous, hardly dilated. Caucasus.

Veitchii, Duthie. Perennial, herbaceous; whole plant covered with minute rather hispid hairs: st. 1-1½ ft. high; lvs. narrowly oblong, lanceolate, 1-2 in. long, acute, cordate at base, crenate-dentate, rugose; the lower stalked, the upper without petioles; fls. in distant whorls; corolla light blue, about 1½ in. long, with a long narrow deflexed tube. W. China. G.C. III. 40:334.—A recent intro. Handsome.

cc. *Fls. scssilc.*

Mussini, Spreng. Diffuse; branches many, ascending; lvs. green above, whitish below; racemes unbranched; bracts much shorter than the calyx; lvs. small, heart-shaped, blunt, deeply notched; corolla blue, darker spotted. Caucasus, Persia. R.H. 1891: 300. B.M. 923 (*N. longiflora*). Gn. 72, p. 563; 74, p. 413; 78, p. 518. A. C. HOTTES.†

NEPHÉLIUM (an ancient name transferred from the burdock, because of some similarity in the rough fruits). *Sapindacæ*. Oriental tropical trees, some of them prized for their fr.; species more than 30. Four frs. prized in the Orient have been referred to this genus, the litchi, longan, rambutan and pulassan, the last one not having a general reputation. Recent botanists, however, separate these into the genera *Euphoria*, *Litchi* and *Nephelium*. The characters of separation are: *Euphoria*. Fr. tubercled with rugose, flattened, sometimes indistinct tubercles; aril free; embryo straight, radicle at the base of the seed; petals present; sepals imbricate: includes the longan or long-yen (*E. Longana*, Lem. *Nephelium Longana*, Cambess. See *Euphoria*). *Litchi*. Fr. tubercled with angular prominent tubercles; aril free; embryo straight, radicle at the base of the seed; petals wanting; sepals valvate, small: includes the litchi (*Litchi chinensis*, Sonn. *Nephelium Litchi*, Cambess. See *Litchi*). *Nephelium*. Fr. echinate-muricate, sometimes smooth; aril adnate to the seed; embryo curved, the radicle near the apex of the seed; petals wanting, in some species present; sepals valvate, small.

The three species mentioned above may be distinguished by the lvs. as follows: The longan has usually 4 pairs (2-5) of lfts., coriaceous, strongly veined, acuminate but more or less obtuse at point, 2-4 in. or more long; the litchi has usually 3 pairs of lfts., coriaceous, indistinctly veined, glaucous beneath, obtusely acuminate, 2-5 in. long; the rambutan has usually 2-3 or more pairs of lfts., chartaceous, strongly veined, often obtuse, 3½-7 in. long; the midrib is somewhat raised above, impressed in the two preceding species. The longan is offered both in S. Fla. and S. Calif. It is said to have been intro. in Calif. probably 25 years ago; it is also reported that the litchi and *Alecryon excelsum* have been sold for the longan. L. H. B.

The rambutan, pulassan and longan.

The rambutan (*Nephelium lappaceum*, Linn.) and the pulassan (*N. mutabile*, Blume) are commonly cultivated in the Malay archipelago, where they appear to be indigenous. The longan (*N. Longana* or *Euphoria Longana*), said by De Candolle to be a native of India, is considerably harder than the first two, and is found as far north as southern China, where it is rather extensively grown.

The rambutan is seen in almost every garden about Singapore and Penang, and its fruit is one of the most delicious of the region. The tree, which grows to a height of 35 or 40 feet, is erect and stately in appearance, with compound leaves composed of five to seven

pairs of oblong leaflets about 4 inches long. It is commonly stated that there are eight or ten varieties of the rambutan, but these appear to differ very little from one another, and are rarely propagated by grafting or layering. The fruits are produced in terminal clusters of not more than ten or twelve, and individually are the size of a small hen's egg, oval in form, and covered with soft fleshy spines ½ inch in length. The color is bright crimson, occasionally greenish or shaded with orange. The pericarp is thin and leathery; to eat the fruit the basal end is torn off, exposing the whitish, translucent juicy pulp or aril, which, with a slight pressure on the apical end of the fruit, slides into the mouth. The flavor is acidulous, somewhat suggesting the grape, and generally considered by Europeans very pleasant, though not equal to that of its relative, the litchi. An oblong flattened seed nearly 1 inch in length is inclosed by the aril.

The pulassan is often confused with the rambutan, which it greatly resembles, but is distinguished by the shorter blunt spines and the aril separating more readily from the seed. The flavor is sweeter and generally preferred to that of the rambutan.

It is not known that either of these species has ever fruited in tropical America, their culture being limited, practically speaking, to southern Asia. They are usually grown from seed, but layering and grafting are often used to perpetuate choice seedlings. The gootee method, described under *Litchi*, is successful.

The longan, called by the French "œil de dragon," or dragon's eye, greatly resembles the litchi except in its smaller size and inferior flavor. It ripens later than the litchi and is very popular among the Chinese, quantities of the fruit being sold in Hong Kong and Canton during late summer. It has been introduced to the United States and planted in both Florida and California, where it fruits abundantly and appears to thrive, when grown in locations which are protected from severe frosts. The fruits, which are produced in large terminal clusters, are ½ inch in diameter, spherical, with a thin leathery pericarp and whitish, gelatinous pulp or aril inclosing a shiny brown seed the size of a bean. The flavor is generally considered rather insipid. As a stock on which to bud the more tender litchi the longan may have considerable value, although its growth is rather slow.

F. W. POPENOE.

NEPHRŌDIUM. A name used by some botanists, especially in England, for species of *Dryopteris*, which see.

NEPHRŌLEPIS (Greek, *kidney scale*, alluding to the shape of the indusia). *Polypodiacæ*. SWORD FERN. A group of tropical and subtropical ferns.

Leaves pinnately divided; pinnae articulated or jointed, the veins free-forking, the sori on upper forks of the veins and with kidney-shaped indusia which are attached inwardly.—Four species are in more or less common cult. Of these, *N. exaltata* is the most important as it is best adapted to general cult. and also it has given rise to a large number of important horticultural varieties. It is, perhaps, safe to say that this species and its varieties constitute the most important single species of fern in cult. for house purposes. The three other species have each given rise to a few varieties but none of them is well adapted to house conditions, so that they are mainly confined to green-houses.

In the index that follows most of the names belong to varieties of *N. exaltata*, or more accurately to varieties of *N. exaltata* var. *bostoniensis*, but in the trade they are counted as species and are given specific names. Technically *N. elegantissima* should have a much longer name if its true relationship were to be indicated. To illustrate, *elegantissima* is a variety of *Pierisii*, which is a variety of *bostoniensis* and this a variety of the

original species, *N. exaltata*. Thus its scientific name is properly *N. exaltata* var. *bostoniensis* var. *Piersonii* var. *elegantissima*. In the present treatment the trade names are used, but in connection with the descriptions the origin of each form is given when known. The index includes all the names that have been met, although no information has been available regarding some of them. Very few of the English varieties are grown at all in the U. S. English varieties are indicated thus: (E).

Methods of cultivation.

In general, nephrolepis must be propagated entirely by runners. Few if any spores are produced by the varieties. As a plant comes to be a year or so old, the leaves develop the usual fruit-dots or sori, but when examined under the microscope it appears that these consist of abortive sporangia or spore-cases and contain no spores. It is probable that spores are developed occasionally, but so rarely that this method can not be used in propagating new plants commercially. A vigorous plant will, however, produce numerous runners which spread in all directions and take root, starting new plants in this way. It is customary to maintain a number of stock plants planted out in benches from which new runners can be plucked as needed. This also gives a good opportunity for the production of new varieties.

New varieties of commercial value do not appear very frequently in the commoner varieties. Most of the present standard varieties have been propagated from single original plants, although there are cases of a certain type of variation occurring simultaneously with different growers, one of whom might count it worthy of introduction while another would disregard it.

All growers unite in acknowledging the original Boston form as the best grower of all and it appears also that there is a greater demand for this form than for any other. The next most popular form is probably *N. Scottii*, with *N. elegantissima* the third. Teddy Jr., and the large frilled forms, *N. Harrisii* and *N. Rooseveltii*, are also grown by most dealers.

There are two main methods of growing nephrolepis for the market, the pot method and the bench method. In the former, stock plants are grown, planted out in the benches, from which new runners are picked from time to time. These are then potted in 2½-inch pots and transferred to larger pots as becomes necessary. In the bench method, the runners are planted out in the benches and grown to good size when they are put into pots, perhaps 6 inches, and kept till rooted, and then sold.

It would appear that the pot method should produce plants which would be better suited to thrive in house conditions, owing to a better establishment of the roots. Then, too, the leaf-growth should also be better, as the transfer from the bench to the full-sized pot would tend to stop vigorous growth for a while.

Some growers market almost their entire product in the form of the bench runners. This of course is entirely wholesale trade. Such runners bring from 4 to 5 cents in thousand lots. When sold in pots, the price depends on the size of the pot. The various kinds bring in general the same prices. Well-grown plants in 6-inch pots sell wholesale at 50 cents apiece.

These ferns are grown from Maine to Florida. In general, a supply from near at hand is better than one coming from a distance. A lot of Boston runners (5,000) obtained from Florida and grown in Massachusetts were recently seen which were most unsatisfactory. At the end of a month there had been scarcely any growth, while for similar runners obtained nearby three weeks should see them well established and ready for sale. One large grower found another danger in Florida importations in the Florida moth, which nearly cleaned out their supply of ferns before they discovered that sprays of hellebore or pyrethrum destroyed it.

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<i>Amerpohlii</i> , 29.	<i>furcans</i> , 2, 3.	Scottii, 9.
<i>Anna Foster</i> , 18.	<i>Gitrassii</i> , 11.	Smithii, 29.
<i>Barrowsii</i> , 18.	<i>giganta</i> , 1 (E).	<i>superba</i> , 3, 33 (E).
<i>Bausei</i> , 3.	<i>gracillima</i> , 29.	<i>superbissima</i> , 30.
<i>biserrata</i> , 3.	<i>Harrisii</i> , 6.	Teddy, Jr., 13.
<i>bostoniensis</i> , 5.	<i>lycopodioides</i> , 32.	<i>tessellata</i> , 1 (E).
<i>enauliculata</i> , 34 (E).	<i>magnifica</i> , 28.	<i>todeoides</i> , 21 (E).
<i>Clarkii</i> , 29.	<i>Milleri</i> , 29.	<i>tuberosa</i> , 1.
<i>compacta</i> , 1 (E).	<i>M. P. Mills</i> , 24.	<i>variegata</i> , 1 (E).
<i>cordata</i> , 1.	<i>multiceps</i> , 2 (E).	<i>viridissima</i> , 15, 30.
<i>cordifolia</i> , 1.	<i>muscosa</i> , 31.	Wagneri, 14.
<i>Craigii</i> , 29.	<i>Neubertii</i> , 29.	<i>Wanamaker</i> , Boston,
<i>davallioides</i> , 2.	<i>New York</i> , 8.	16.
<i>Duffii</i> , 1.	<i>pectinata</i> , 1.	<i>Whitmanii</i> , 20.
<i>Dwarf Boston</i> , 12.	<i>Piersonii</i> , 17.	<i>Whitmanii compacta</i> ,
<i>elegantissima</i> , 19.	<i>plumosa</i> , 1.	26.
<i>elegantissima com-</i>	<i>robusta</i> , 22.	<i>Wittboldii</i> , 35.
<i>pacta</i> , 25.	<i>Rochfordii</i> , 29 (E).	Wm. K. Harris, 6.
<i>Elmsfordii</i> , 27.	<i>Rooseveltii</i> , 7.	

A. Rootstocks with small tubers.

1. *cordifolia*, Presl (*N. tuberosa*, Hook. *N. cordata*, Hort.). Lvs. numerous, tufted, with stiff petioles, 15-30 in. long, 1½-2 in. wide, with close often overlapping pinnae, these usually blunt and crenulate. Mex., Japan, and New Zeal.—A rather slow grower. It reproduces by runners but less freely than *N. exaltata*. Commonly known in the trade as *N. cordata* and under this name has several varieties as vars. *compacta*, *giganta*, *tessellata* and *variegata*. Var. *plumosa*, common in the trade as *N. tuberosa plumosa*, is a beautiful form with glossy dark lvs. which have the pinnae once-pinnate in the outer half or two-thirds. Var. *Duffii* is a remarkable wild variety with the pinnae reduced to one or two rounded segms. Var. *pectinata* lacks the tubers and has narrower, more spreading lvs. Probably a distinct species.

AA. Rootstocks without tubers.

B. Sori on special narrow segms. of the fertile lvs.

2. *acuminata*, Kuhn (*N. davallioides*, Kunze). Lvs. drooping, 2-3 ft. long, 1 ft. or more wide, the lower pinnae incised crenate, the upper pinnae narrower, with deeper lobes, each with a single sorus at the apex. Java.—A cult. variety with forked pinnae is grown, advertised as *N. furcans* and *N. furcans multiceps*.

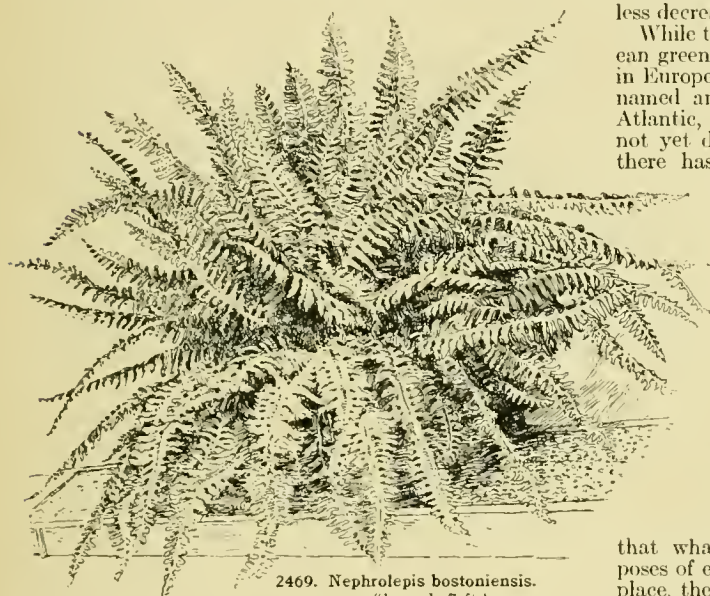
BB. Sori along margins of ordinary divisions of lvs.

3. *biserrata*, Schott (*N. acuta*, Presl. *N. Bausei*, Hort.). Lvs. few, 30-55 in. long, 8-12 wide, drooping, the pinnae often distant, elongate, narrow, with entire or crenulate margins, rounded in the lower half of the base, auricled in upper half, leathery. Pan-tropic. *N. rufescens* is a scaly form. Var. *superba*, usually ascribed to *N. exaltata*, may be a variety of *N. biserrata*. It is characterized by a crested many-forked apex, and has lacinate-margined pinnae. Var. *furcans* has the pinnae once or more forked.

4. *exaltata*, Schott. SWORD-FERN. Lvs. rather rigid and erect, 2-5 ft. long, 3-6 in. wide, oblong, tapering toward the point, the pinnae rather close, acute, entire or crenulate, the upper side auricled. Fla. to Brazil, Hong-Kong and E. Afr.—This description applies only to the wild species. It is impossible to give a description which will include all the forms which have been derived from this species. Each distinct form needs separate treatment. The varieties of *N. exaltata* have practically all arisen in the last twenty years, since the early nineties. At that time this species was grown to some extent by florists as a house-plant but was not more common than many flowering species. It happened, however, that in a lot of this species of about 200 plants, shipped by Robt. Craig & Co., of Philadelphia, to P. C. Becker of Cambridge, Mass., there was discovered one plant which differed from the ordinary *exaltata* in being more graceful, slightly broader, and a quicker grower. The purchaser identified this plant as the species *acuminata* or, as it was then called, *daval-*

lioides, and proceeded to raise and sell it by the scores of thousands. Later, when a specimen of the fern came into the hands of G. W. Oliver, the latter raised the question of its identification and declared that it was not *davallioides* but *exaltata*, though not the typical form. For some time thereafter Messrs. Becker and Oliver exchanged opinions in the "Florists' Exchange," until Oliver's determination was accepted. The nomenclature commission of The Society of American Florists did not feel competent to give a name to the new variety so it was sent to Kew where it was suggested that the neighborhood of its discovery might well be honored by calling it *bostoniensis*. This name was given in 1896. The fern had been on the market for a year or more previously.

For nearly ten years the Boston fern held undisputed sway. The original species-form was superseded owing to its less graceful stiffer habit. Then in 1903



2469. *Nephrolepis bostoniensis*.
(Spread, 7 ft.)

there appeared a new type of variation in the greenhouses of F. R. Pierson, of Tarrytown, N. Y.

In this new form, the Boston fern departed from its once-pinnate type to give rise to a twice-pinnate form which was introduced as *Piersonii*. But this fern was not consistently once or twice pinnate but both, and after a time it appeared that this unstable condition was not very satisfactory. It was found possible to obtain by careful selection a more fixed type of the twice-pinnate form and when this was introduced it was given the name of *elegantissima*. This was followed by other forms showing the two-pinnate character, and later forms appeared three and even four times divided.

A year or two later, in Brooklyn, another type of variation developed from the Boston fern. This was the dwarf type, with which came some other differences, but with the once-pinnate character retained as in the parent form. John Scott brought out the first of these dwarf types but there are now a half-dozen different dwarf once-pinnate forms.

About this time Harris, of Philadelphia, discovered and introduced a once-pinnate type with beautifully waved pinnae and called it *Harrisii*. This has since been followed by wavy dwarfs, wavy twice-pinnate forms. Pierson again came to the front with a new type of variation in which the leaves are irregularly

curled and twisted so that the resulting leaf becomes a dense thick mass of divided pinnae, the *superbissima* and *muscosa* forms.

At the present time, with these four main types of variation to start with, and with others, such as thickness of petiole, rapidity of growth, stability of form, and the like, there have come almost all possible combinations and mixtures of these main types so that within certain limits almost anything is possible. Every grower who produces any quantity of these forms is having new types develop in his beds. Many of these are of no commercial value. A few new ones are introduced each year but some which at first appear good prove to have serious defects after testing for a year or two.

It is an interesting fact that, after ten years of new forms, the old Boston fern still holds its own and sells more readily and in larger amounts than any new form. It appears that with the later variations there has come also less adaptability to house conditions and more or less decrease in the vigor of growth.

While these variations have been appearing in American greenhouses, the same thing has been taking place in Europe. In some cases the new forms produced and named are practically identical on both sides of the Atlantic, but each region has produced distinct types not yet developed by the other. Generally speaking, there has been almost no importation into North America of the new European forms. For this reason little attention is here paid to European forms in this treatment. Not much is known about them by our growers and collectors.

The classification of the forms of *N. exaltata* is a difficult problem on many accounts. In the first place, owing to unscientific horticultural methods of description and publication of names, it is practically impossible to get accurate printed records of the different forms. Some growers have the custom of merely placing a new form on the market without so much as a catalogue or periodical advertisement. At best it is a case of advertising descriptions for the purpose of sale so

that what is stated can not be accepted for the purposes of close and accurate description. In the second place, the types of the variations themselves are often of such a character that it is hard to draw up good differential descriptions. Two varieties may vary not at all in the cutting of the leaves but very markedly in the important characters of cultural needs and response. Again, it is usually the case that earlier varieties become superseded by later ones of greater commercial possibilities. The grower then has no sentiment about the original forms but discards them, so that it is practically impossible now to get plants of some of the early stem-varieties from which nearly all of the later have sprung. Added to these difficulties is often indifference on the part of growers to the need of accuracy in naming forms. A single form may be sold by different florists under totally different names.

The descriptions given below of the various forms have been drawn up as far as possible from authentic material obtained from the original producers themselves. Numerous visits have been made to growers in the neighborhood of New York, Boston, and Philadelphia. A collection of living plants has been started at the Brooklyn Botanic Garden, the main object of which is to gather authentic plants of the varieties. It should be noted here that, however careless as to the accuracy of descriptions and names the various growers have been, they have been exceedingly courteous in affording opportunities for study and in giving such information as they possessed.

The varieties chosen for description are those found

to be in actual cultivation for the trade in the United States, together with some formerly in the trade but important because the modern varieties have sprung from them. Whenever possible, other varieties have been given incidental description by comparison with the more important forms. In some cases it has not been possible to settle the claims advanced for two or more similar varieties and in such cases the varieties have been given coordinate treatment with a single description. English varieties about which little information has been available have been mentioned where possible in connection with similar American forms.



2470. *Nephrolepis Harrisii*. ($\times \frac{1}{2}$; pinna $\times \frac{1}{2}$)

In the key below dimensions given are for well-grown plants in 6-inch pots. In the smaller varieties, these dimensions are maximum, but some of the larger types may develop leaves as long as 6 feet.

A. *Exaltata* forms with lvs. 1-pinnate or sometimes pinnate-pinnatifid.

B. Length of lvs. $2\frac{1}{2}$ –3 ft.

C. Pinnae plane, the margins straight.

5. *bostoniensis*. Fig. 2469. Intro. by F. C. Becker, 1895. Free-growing, the lvs. dark green, spreading or hanging according to the light, the petioles rather succulent, the pinnae linear-lanceolate, acute, 3–4 in. long, $\frac{1}{2}$ – $\frac{3}{4}$ in. wide, entire or crenulate, plane or slightly undulate, herbaceous, less stiff than type form, with more graceful and broader pinnae. The standard variety and best of all for general purposes. Good as a pot-plant (6 in. or more) or in baskets, on palm trunks or in the rockery. It may be planted out in the southern states.

cc. Pinnae wavy.

6. *Harrisii*. Fig. 2470. Wm. K. Harris, from *bostoniensis*. Wm. K. Harris, Wm. K. Harris, from *Harrisii* is merely *Harrisii* selected for the greater waviness of the pinnae. See *Rooseveltii*.

7. *Rodseveltii*, Amer. Rose and Plant Co., from *bostoniensis*. Like *bostoniensis*, except for the pinnae which are beautifully waved and usually auriculate. *Rooseveltii* is exactly like the Harris forms as to the undulation of the pinnae, but is not quite so large a form and can consequently be better grown in 6-inch pots. Both make beautiful plants when well grown. *Harrisii* and *Rooseveltii* probably represent separate sports of two distinct types of Boston fern which exist in the trade, one taller than the other.

8. New York, Giatras, 1913, from *Giatrasii*. Somewhat smaller than *bostoniensis*, the lvs. slender, narrow, the pinnae somewhat undulate, 2–3 in. long, often blunt, the petiole slender, wiry. Good when well grown but rather slow. Like *Giatrasii* but larger.

mm. Length of lvs. 15–24 in.

c. All the pinnae entire, not pinnatifid.

d. Pinnae not wavy or twisted.

9. *Scottii*, Jno. Scott, from *bostoniensis*. Lvs. spreading, recurved, the pinnae close, revolute and recurved, the petioles stoutish, rather succulent, strong. This is the commonest of the dwarf varieties. When well grown, it forms a compact dense cluster of lvs. which have good lasting qualities. It is somewhat subject to white scale, and is slower than Teddy Jr.

10. *falcata*, Wagner, from *Scottii*. Like *Scottii*, except that ends of pinnae are 1- or 2-forked.

11. *Giatrasii*, Giatras, 1909, from *bostoniensis*. About the same size as *Scottii*, perhaps a little smaller, but different in having more flexible lvs., wiry petioles and midribs, nearly plane pinnae. Well-grown plants perhaps more graceful than *Scottii* but slower-growing and therefore not so much used.

12. Dwarf Boston, F. R. Pierson, from *elegantissima compacta*. A little taller and more free-growing than *Scottii*, lvs. straighter, the pinnae nearly plane.

dd. Pinnae wavy or twisted.

13. Teddy Jr., Amer. Rose and Plant Co., from *Rooseveltii*. Free-growing, dark green, with wavy pinnae as in *Harrisii* or *Rooseveltii*. The pinnae are broader than those of *Scottii*, the color is darker, and the plants quicker-growing. Replacing *Scottii* to some extent.

14. *Wagneri*, Wagner, from *Scottii*. A dwarf sport of *Scottii* with the pinnae very close and somewhat curved. Resembles *viridissima*, but more regular.

15. *viridissima*, Pierson, from *superbissima*. Lvs. dark green, rigid, erect, with twisted, closely imbricated pinnae. Inherits the irregularity of *superbissima* and represents a 1-pinnate reversion. Found to be too slow-growing and too stiff to be valuable for trade.

cc. All or some of the pinnae deeply lobed or pinnatifid.

16. *Wanamaker Boston*, Craig, 1915, from *Scholzii*. Lvs. rather narrow, erect and spreading, the pinnae wavy, sometimes deeply lobed or pinnatifid in the outer halves, auriculate or with a single separate pinnule at the bases, often bent forward or backward. (This form represents the selection and prop. of the once-pinnate type of lf. often found on *Scholzii*.)

AA. *Exaltata* forms with lvs. 2-pinnate or 2-pinnate-pinnatifid.

B. Length of lvs. 2 ft. or more.

17. *Piersonii*, F. R. Pierson, 1902, from *bostoniensis*. The first of the 2-pinnate forms and now discarded. Tall-growing, with the habit of *N. bostoniensis*, the lvs. unevenly divided, some 1-pinnate, some partly once- and partly twice-pinnate, and some entirely 2-pinnate. Important, because nearly all the later 2-pinnate types have come from it, but not itself desirable.

18. *Barrowsii*, Barrows, 1905, from *Piersonii*. Much like *Piersonii*, but somewhat differently divided. Another form of this type was called "Anna Foster." From this have come *Whitmanii* and *Magnifica*.



2471. *Nephrolepis elegantissima compacta*. ($\times \frac{1}{2}$; pinna $\times \frac{1}{2}$)

BB. Length of lvs. about 18 in.

19. *elegantissima*, F. R. Pierson, 1904, from *Pier-sonii*. Lvs. 18–20 in. long, 6–8 in. broad, the pinnae 3–4 in. long, $1\frac{1}{2}$ –2 in. broad, almost completely divided into elongate, acuminate pinnulae, these 1 in. long, $\frac{1}{2}$ in. broad, entire or deeply pinnatifid into linear segms. The most commonly grown of the 2–3-pinnate varieties. It succeeds because of a strong petiole and firm lf.-blade. The lvs. are often thick and dense, due to the broad overlapping pinnae. A well-grown plant shows a very thick mass of lvs. *Elegantissima* “improved” is the stock grown at present and represents a selected type of *elegantissima* which shows less reversion than the original form. However, when not carefully grown, it will now show strong reversion to the once-pinnate Boston type.

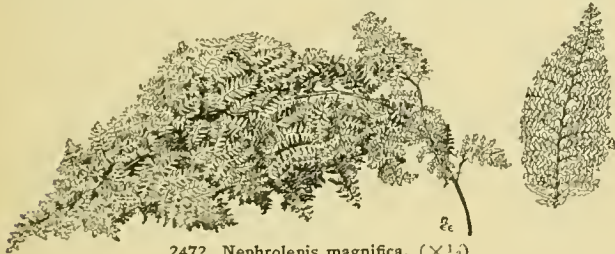
20. *Whitmanii*, Barrows, from *Barrowsii*. In general, similar to *elegantissima* but the lvs. are more open, and the segms. smaller, less elongate than those of the Pierson form. *Whitmanii* “improved” is similar but shows less reversion. The differences in lvs. result in a less dense habit of growth. Reversion is uncommon under good conditions.

21. *todeoides*, Rochford (English). Like *elegantissima* but with even more elongate pinnulae.

22. *robusta*, Craig, 1912, from *elegantissima*. Lvs. 2–2 $\frac{1}{4}$ ft. long, 10–12 in. wide, erect, firm, 1–2-pinnate, the pinnae 4–6 in. long, $1\frac{1}{2}$ –2 in. broad when 2-pinnate, lobed at the base, narrower when not divided, the pinnulae full, entire or crenulate. For the first year or so after its intro. this form showed little reversion but more recently it has begun to throw 1-pinnate lvs. It is a larger more open form than *elegantissima* and consequently more hardy. From *Piersonii* it differs in being broader-lyd. and more erect.

BBB. Length of lvs. about 15 in. or less.

23. *Schölzelii*, Scholzel, 1908, from *Scottii*. Lvs. 15 in. long, 4–5 in. broad, erect, simply 2-pinnate, the pinnae somewhat recurved as in *Scottii*, often revolute, the pinnulae large, $\frac{1}{4}$ – $\frac{1}{2}$ in. long, entire or crenulate. Under the name *Schölzelii*, there is also sold a 3-pinnate form which arose in 1909 at Scholzel's place but



2472. *Nephrolepis magnifica*. ($\times 1\frac{1}{2}$)

which has never been given a separate name. Some of these 3-pinnate plants are erect, some have spreading lvs. Both belong in the next section with the 3-pinnate.

24. *M. P. Mills*, Harris, from *Scottii*. A twice-pinnate form with small distant segms., characterized by extreme hardness and by very frequent reversion to the 1-pinnate type. The reverted plants do not appear to be ordinary *Scottii*, but have straight pinnae and a more open growth. Both are slow.

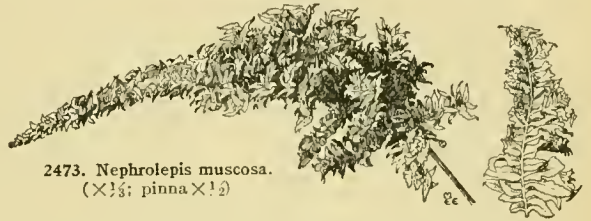
25. *elegantissima compacta*, Fig. 2471, F. R. Pierson, 1909, from *Piersonii*. Lvs. about 12 in. long, erect, dense, numerous. In cutting like *elegantissima* except that it is often more divided and may be 3-pinnate.

26. *Whitmanii compacta*, Barrows, from *Whitmanii*. Lvs. 15–18 in. long, very full, nearly 3-pinnate. A beautiful form, the lvs. possibly a little soft.

27. *Elmsfordii*. Lvs. 12 in. long, 2–3-pinnate, with wiry petioles and a spreading habit. A pretty little form but not well known.

AAA. *Exaltata* forms with lvs. regularly 3-pinnate or finer.

28. *magnifica*, Fig. 2472, Barrows, from *Whitmanii*. Lvs. erect, 15 in. long, 4–5 in. broad, 3-pinnate with



2473. *Nephrolepis muscosa*. ($\times 1\frac{1}{2}$; pinna $\times 1\frac{1}{2}$)

small ovate segms., $\frac{1}{8}$ – $\frac{1}{4}$ in. long. A free grower of open habit, rather light green. More like the forms of the preceding section.

29. *Smithii*, J. C. Clark, from *Amerpohlii*. LACE-FERN. Lvs. 3-pinnate, 8–12 in. long, 6–8 in. broad, divided into very small, close segms. $\frac{1}{8}$ in. long. The pinnae are crowded so that the lvs. become very dense and are thus liable to injury by careless watering. There are a number of named varieties of the same general type but differing in growth characteristics. *Smithii* seems to be the most generally used. Others are as follows: *Amerpohlii*, *Amerpohl*; *gracillima*, *Barrowsii*, from *magnifica*; *Clarkii*, *Smith*, from *Smithii*. *Milleri*, *Miller*; *Neubertii* (German); *Rochfordii* (English); *Craigii*, *Craig*, from *Smithii*, is 4-pinnate, with linear segms., but too soft to be of commercial value.

30. *superbissima*, Pierson, 1908, from *elegantissima*. Lvs. mainly spreading, the pinnae closely imbricated and irregularly twisted, firm, dark green, long-pointed, 10–15 in. long, 3–5 in. broad. A very interesting type, though not widely grown owing to its oddity and slowness. A single lf. may be very firm and dense. Throws buds with 1-pinnate lvs. frequently and these selected and grown constitute the var. *viridissima*.

31. *muscosa*, Fig. 2473, Pierson, 1911, from *superbissima*. Practically dwarf *superbissima*, but makes more symmetrical plants and shows fewer reverting lvs. Lvs. 6–8 in. long, 4–5 in. broad, spreading, very firm and dense with the pinnae and segms. closely imbricated. Like *superbissima* it is not widely grown. It is slow, and is also liable to injury from water, the lower pinnae of the lvs. falling off.

32. *lycopodioides*, Rochford. Finely divided, irregularly twisted. Apparently like preceding but more finely cut. Probably not yet grown in the U. S.

Additional distinct types not commonly grown in Amer. and which are probably not derived from *exaltata* are:

33. *superba*, May. Lvs. 20–25 in. long, 4–5 in. broad, the pinnae deeply laciniately lobed, with the apices forked and crested, more or less recurved. A single lf. simulates well an ostrich plume.

34. *canaliculata*, May. Has involute lvs. with the tips of the pinnae lacinate and crested.

35. *Wittboldii*, (F. R. 5:247) is described as having lvs. 3 times as broad as the typical *bostoniensis*.

Other forms which do not appear to be in the American trade to any extent are: *N. Bitchelori*, *crispato-congesta* (E), *Dreyeri*, *edmontoniense* (E), *Falkneri* (E), *Fosteri* (E), *grandiceps* (E), *Hestonii* (E), *Marshallii*, *Marshallii compacta*, *Mayeri* (E), *ornata* (E), *philipinensis*, *recurva* (E), *rugosa* (E), *serrulata*, *splendens* (E), *tripinnatifida*, *washingtoniensis*, *Westonii* (E), *Wildei*, *Willmoti*.

R. C. BENEDICT.

NEPHTHYTIS (name borrowed from Egyptian mythology; Nephtys, mother of Anubis, wife of Typhon). *Araceæ*. Tropical African creepers, two of which are cultivated in hothouses for their variegated foliage.

Leaves more or less halberd-shaped or arrow-shaped, with scarcely any sheath on the petiole; infl. terminal; spathe concave-expanded; ovary 1-celled; ovule solitary, pendulous.—About half a dozen species.

picturata, N. E. Br. The white markings form a pattern resembling the tips of fern fronds laid between the nerves, with their points all directed toward the base of the midrib; plant stemless, spreading by runners; petioles 10–12 in. long; blade 6–12 in. long, 5–9 in. broad. Congo. Var. *angustata*, N. E. Br., has smaller and narrower lvs. Figured in catalogues of U. S. Nurseries, 1895.

triphylla, Hort. "A pretty stove creeper with dark green thrice-divided lvs. marked with greenish white in the exact shape of the fl."

Afzëlii, Schott (*N. libérica*, N. E. Br.). Lvs. glabrous, the petiole 7–20 in. long, 1–2 in. thick, the blade sagittate, the portion in front of petiole-insertion up to 10 in. long, the basal lobes up to 6 in. long; spathe green, 2–2½ in. long. W. Trop. Afr. GEORGE V. NASH.†

NEPTÛNIA (*Neptune*, god of the sea; some of the species are aquatic). *Leguminosæ*. Perennial herbs, or subshrubs, often floating, one of which is an aquarium plant.

Unarmed, prostrate or diffuse, the branches usually flattened or triquetrous; lvs. bipinnate, sometimes sensitive, the lfts. small; fls. not papilionaceous, perfect

or polygamous, in spikes or heads on axillary peduncles; calyx 5-lobed; petals 5, distinct or somewhat cohering; stamens 10 or 5, exserted; pod oblong, oblique, 2-valved, somewhat septate between the ovate compressed seeds.—Species perhaps a dozen, widely spread in the tropics; a few of them are in the extreme southern U. S. and are plants of moist or even dry soil.

plëna, Benth. (*Mimosa plëna*, Linn. *Desmáanthus plënus*, Willd.). Natant, with prostrate sts., foliage sensitive and much like that of the common sensitive plant, *Mimosa pudica*; the fls. are so odd that one at first sight would not imagine that they belong to the legume family. They are small and collected in an ovoid head, 1½ x 1 in. and borne singly on stalks 6 in. long. These heads or spikes are drooping and have numerous stamens. The singular feature of these fls. is a mass of yellow petalage composed of 6 or more tiers of reflexed narrowly lanceolate bodies, which are really transformed and sterile stamens. The plant floats on pools and has grooved sts., the part under water being white, spongy and full of air-cells. Lvs. alternate and far apart; lfts. many, crowded, linear, obtuse. It is of difficult cult. and can probably not be secured in the trade at present. It grows in the E. Indies and S. Amer., and Mex. and elsewhere. B.M. 4695. B.R. 32:3. L. H. B.

NERINE (a nereid of Greek mythology). *Amaryllidææ*. Handsome autumn-flowering bulbs from South Africa.

Bulb tunicated, mostly without a neck; lvs. appearing after the fls. or with them, usually strap-shaped; fls. in shades of red and pink (varying to white), in few- or many-fl. umbels on a slender or robust scape; spathe-valves beneath the umbel 2, lanceolate; perianth funnel-form, very deeply cut or divided, erect or somewhat decurved, the 6 segms. equal, narrow and more or less crisped or undulate; stamens 6, usually unequal, declined or nearly erect, bearing versatile anthers; style long and slender, straight or somewhat declined; fr. a globose 3-lobed and 3-valved caps., with seeds 1 or few in each cell.—Species 15–18, in Afr. from the Transvaal and Kalahari south to Cape of Good Hope. Monographed by Baker, *Flora Capensis*, vi (1896–7), from which the following descriptive account is mostly drawn.

Nerine is a remarkable genus of tender bulbous plants, of which the commonest species is *N. sarniensis*, long known as the Guernsey lily from the island where these bulbs are grown to perfection. The winter is their growing season instead of flowering time. They belong to the very small class of autumn-blooming bulbs. The common kinds flower from September to November without any foliage, and the leaves are developed all winter. About May the leaves die down and the bulbs rest from May to August. The leaves appear after the flowers in two or three species, but with the flowers in the others.

The flowers range from scarlet through salmon and pink shades to white, and are borne in umbels of four to twenty flowers, on scapes varying from 1 to 3 feet long and averaging 1½ feet. A trade name is *Nerine japonica*, which is really a *Lycoris*; it has black seeds, while all the true nerines have green seeds. It has, however, the autumn-blooming habit and flowers of the same general appearance as the true nerines. The nerines have two distinct types of beauty, illustrated by Figs. 2474 and 2475. The kinds with the narrow perianth-segments, which are crisped or fluted, have a spidery look and are not so popular as the kinds with broad, flat segments, which make a showier cluster of flowers. The segments vary from ⅓ to ½ inch in width. The showiest kinds are hy-



2474. *Nerine curvifolia*
var. *Fothergillii*.
(× ¾)

brids or varieties of *N. sarniensis* and *N. curvifolia*, the former species being the most prolific of varieties. In these two species the strong vertical lines of the erect long-protruded stamens make a striking feature. The flowers of the other species have more of a drooping tendency and the stamens are shorter and declinate, as in Fig. 2475. *N. pudica* is perhaps the choicest white-flowered kind. Nerines have bulbs 1 to 2 inches or less in diameter, and about six leaves, varying from 8 to 18 inches in length and 4 to 9 lines in width. Among the uncultivated kinds are some with short stout scapes and others with appendages at the base of the filaments. Nerine is closely related to *Brunsvigia*, being separated technically on the character of the capsule which is globose and obtusely angled in Nerine as distinguished from turbinate and acutely angled in the other. This distinction, however, seems not always to hold clearly. To the gardener, the differences are largely in relative size, *Brunsvigia* having larger bulbs, more numerous mostly larger flowers and commonly broader leaves.

The nerines are treated mostly as greenhouse plants. When well established in pots, they bloom year after year. In winter, the foliage is grown, and in spring water is gradually withheld until the bulbs are well ripened, when they remain dormant until August. John Robertson, in "Florists' Review" 1:675, gives advice as follows: the secret of success with nerines is to secure the fullest possible development of the bulbs. This refers to their winter treatment. They enjoy abundance of water at the root and overhead, with occasional applications of liquid manure. This treatment should never cease until the leaves turn yellow, which is a sign that the plants are finishing their growth. Then diminish the water-supply gradually, lay the pots on their sides where they are not likely to get wet, and in full sunlight, so that the bulbs may ripen thoroughly. The plants should not have their roots disturbed, nor do they require much root room: they grow and flower best when hard pot-bound. Three bulbs planted in good fibrous loam with a little sand may remain in a 5-inch pot for five or six years, or even longer, as the offsets can be rubbed off and separately potted while the parent bulbs go on increasing in size. Each year as the flower-scape appears pick off about an inch of the surface soil with a sharp-pointed stick, and give the ball of roots a good soaking and a slight top-dressing.

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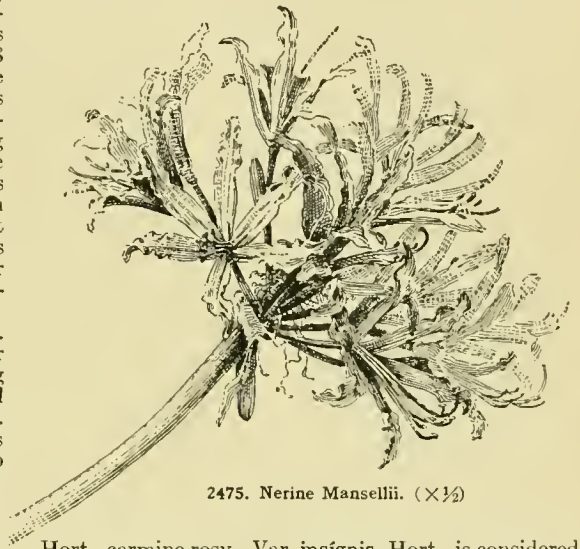
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A. Stamens and style nearly erect.

a. Lvs. green, suberect.

1. *sarniensis*, Herb. GUERNSEY LILY. Bulb ovoid, to 2 in. diam., the coverings pale brown: lvs. about 6, bright green, developed after the fls., about 1 ft. long, linear, not curved laterally: scape or peduncle 12-18 in. high: fls. bright crimson, 10-12 in an umbel; perianth-segms. oblanceolate, $\frac{1}{2}$ in. or less broad, falcate, slightly crisped; filaments suberect, bright red, longer than the segms. Coast region, S. Afr. B.M. 294. R.H. 1912, p. 455; 1913, p. 456. It runs into many forms, as: Var. *Plantii*, Baker (*N. Plantii*, Hort.), has a longer scape, duller fls., and more distinctly clawed segms. Gn. 21:200. Var. *venusta*, Baker (*N. venusta*, Herb.), has bright scarlet fls. produced earlier than any of the other varieties. B.M. 1090 (as *Amaryllis venusta*). Var. *rosea*, Baker (*N. rosea*, Herb.), has lvs. darker green than the type: fls. rose-red: seeds oblong instead of globose. B.M. 2121 (as *N. rosea*).

Var. *corusca*, Baker (*N. corusca*, Herb.), has bulb tunics not chaffy: lvs. broader than in the type, with distinct cross-bars between the main veins: fls. large, bright scarlet. B.M. 1089 (as *Amaryllis humilis*). Gn. 21:200. *N. corusca major* has rich crimson-red fls. Var. *carnosa*,

2475. *Nerine Mansellii*. ($\times \frac{1}{2}$)

Hort., carmine rosy. Var. *insignis*, Hort., is considered by Baker synonymous with the type of the species, but is probably horticulturally distinct. The fls. are said to be rosy.

bb. Lvs. glaucous, sickle-shaped.

2. *curvifolia*, Herb. Bulb ovoid, to 2 in. diam., the coverings pale brown: lvs. 6, appearing after the fls., strap-shaped, curved laterally, thicker than in *N. sarniensis*, about 1 ft. long: scape or peduncle slender and glaucous, 12-18 in. long, the umbel 8-12-fl.: fls. bright scarlet; perianth-segms. hardly crisped, oblanceolate, $\frac{1}{4}$ in. broad, falcate; stamens erect or nearly so, about as long as the perianth-lobes. S. Afr. B.M. 725 (as *Amaryllis curvifolia*).—Cult. in the form of var. *Fothergillii*, Baker (*N. Fothergillii*, Roem.), which is more robust in all parts (Fig. 2474): fls. more numerous, between crimson and scarlet. R.B. 22:13. Gn. 22, p. 463. G. 3:503; 5:380. Var. *Fothergillii major* (*N. Fothergillii major*, Hort.) is a form with still larger fls. J.H. III. 55:277. F.R. 1:675.

AA. Stamens and style declined.

B. Outer fls. of the umbel opening before the inner ones.

c. Segms. distinctly crisped or fluted.

3. *flexuosa*, Herb. Bulb subglobose, $1\frac{1}{2}$ in. diam.: lvs. 4-6, appearing with the fls., linear-strap-shaped, arcuate, bright green, $\frac{3}{4}$ in. or less broad, sometimes pustulate: scape flexuous, longer than in the other kinds, sometimes 2-3 ft. long: fls. generally pale pink, the segms. oblanceolate and crisped, $\frac{1}{2}$ in. broad; stamens declined, the 3 longer ones rather shorter than the segms. Kalahari and central region of S. Afr. B.R. 172. R.H. 1913, p. 456. Var. *pulchella*, Baker (*N. pulchella*, Herb.), has glaucous lvs., firmer than in the type: scape not flexuous: fls. pale pink, keeled rose-red. B.M. 2407 and Gn. 21:200. Var. *Sandersonii*, Baker, has peduncle and pedicels more robust and lvs. 1 in. broad: perianth-segms. less crisped, $1\frac{1}{4}$ in. long, and more distinctly united in cup at base. Var. *alba*, Hort., has white fls. G.C. III. 40:336. N. Mansellii, O'Brien, Fig. 2475, is a fine hybrid between *N. flexuosa* and *N. Fothergillii*. Gn. 56:378. It has very broad fleshy lvs. and bright red slightly irregular fls. This is one of the most interesting kinds.

cc. Segms. hardly or slightly crisped.

1. *pudica*, Hook. f. Bulb globose, about 1 in. diam.: lvs. 4-6, glaucous, 8-9 in. long, suberect, appearing with the fls.: umbels 4-6-fld., the other kinds being 8-20-fld.; fls. white, keeled pink above; segms. oblanceolate, thin, scarcely crisped; stamens declined, the 3 longest a little shorter than the perianth-segms. Original habitat in doubt. B.M. 5901. R.H. 1913, p. 456. F.S. 23:2161. Gn. 21:200. Var. *Élwesii*, Baker (*N. Élwesii*, Leichtl.), has much broader bright green more persistent distinctly veined lvs. with a prominent midrib; fls. more compact and pedicels stouter; segms. pale rose with a darker keel, thicker and more wavy. Var. *álba*, Hort., fls. snow-white.

5. *Böwdenii*, W. Wats. Bulb variable in size, the largest bottle-shaped and $1\frac{1}{2}$ in. diam. and 2 in. long, freely producing offsets; lvs. $\frac{1}{2}$ -1 ft. long and 1 in. or less broad, glossy green, slightly channeled, obtuse; scape nearly cylindrical, 12-18 in. long, bearing a loose 6-12-fld. umbel 9 in. across, the trigonous pedicels 2 in. long; fls. large, rose-pink with keels darker; segms. 2-3 in. long and $\frac{1}{2}$ in. wide, recurved and slightly wavy. Cape Colony. B.M. 8117. G.C. III. 36:365. Gn. 77, p. 570. F.S.R. 3:120.—As grown at Kew, the plants are practically leafless when in fl. Var. *pállida*, Hort. (*N. Veitchii*, Hort.), is pale in color (blush-white); fls. $2\frac{1}{4}$ in. across, with recurved segms. Gn. 75, p. 484. G.M. 54:742. G.C. III. 58:132.

BB. Outer fls. opening after the inner ones.

6. *undulata*, Herb. Bulb ovoid, to 1 in. diam., the coverings membranaceous and pale; lvs. 4-6, linear, appearing with the fls., bright green, 12-18 in. long and $\frac{1}{2}$ in. or less broad; peduncle slender, 12-18 in. long, bearing a centrifugal 8-12-fld. umbel; fls. pale pink, perianth, $\frac{3}{4}$ in. or less long; segms. oblanceolate, very narrow and much crisped. Kalahari region and coast region, S. Afr. B.M. 369 (as *Amaryllis undulata*). Gn. 76, p. 136. Var. *máior*, Tratt. Perianth-limb larger, less crisped.

7. *humilis*, Herb. Bulb ovoid, to $1\frac{1}{2}$ in. diam., the coverings membranaceous; lvs. about 6, appearing with the fls., linear, bright green, channeled on the face, about 1 ft. long and $\frac{1}{2}$ in. broad; scape or peduncle often smaller than in the other kinds, $\frac{1}{2}$ - $1\frac{1}{2}$ ft. high; fls. bright pink or rose-red, 10-20 in an umbel, the perianth $\frac{1}{4}$ in. or less long; segms. oblanceolate, acute, crisped; stamens declined, the 3 longer about as long as segms. Coast region, S. Afr. B.M. 726 (as *Amaryllis humilis*). Gn. 21:200. Var. *spléndens*, Hort., is presumably the best form of this species. Fls. purple-crimson.

The following names are mostly important hybrids which in many cases are more popular than the species: *N. andibilis* (*N. pudica* $\times$ *N. humilis*), rosy, dark-striped. Var. *grandiflora*, Hort. Van Tubergen, has larger fls.—*N. chindiba*, Miq. Pure white, the fls. 15-20, each about 2 in. diam., the segms. undulate; hardly distinguishable from *N. flexuosa* var. *alba*. Offered abroad.—*N. crispata*, Hort. Thorburn, scarlet.—*N. degans* (*N. flexuosa* $\times$ *N. sarniensis* var. *rosea*), pink. Var. *carminata*, crisse. Var. *cerulea*, shaded blue.—*N. excellens*, Moore (*N. flexuosa* $\times$ *N. humilis* var. *máior*), carnine rosy, dark-striped.—*N. excellens máior tardiflora*, Hort.—*N. Bowdenii*.—*N. Gaiminii*, Hort., is an erect-flowering form of the *sarniensis* group, with large bright pink fls. "keeled throughout with red;" fls. about 10 in an umbel, each 2 in. across.—*N. Haycockii* (*N. curvifolia* $\times$ *N. flexuosa* var. *pulchella*). One of the oldest hybrids in cult. Raised by Wm. Herbert. The others in this list are more modern.—*N. japonica*, Miq.=*Lycoris radiata*.—*N. Madagaskari* (*N. sarniensis* $\times$ *N. curvifolia* var. *Fothergillii*).—*N. O'Brienii* (*N. pudica* $\times$ *N. sarniensis* var. *Plantii*). Var. *crubra*, Van Tubergen, pale violet, tinged blue.—*N. tardiflora*, Hort. Van Tubergen, not accounted for by Baker. Fls. bright red in Dec.—*N. Zoroaster*, Hort., is a garden hybrid between *N. pudica* and *N. sarniensis* var. *corusca*.

WILHELM MILLER.

L. H. B.†

NÈRIUM (ancient name for oleander, supposed to be from Greek *neros*, "moist," alluding to the places in which it grows wild). *Aspocéece*. The oleander is an old-fashioned evergreen shrub known to everybody, and cultivated everywhere in southern countries. In

the North the oleander is a common house plant, being grown in tubs for summer decoration, and ranking in popularity with sweet bay and hydrangea.

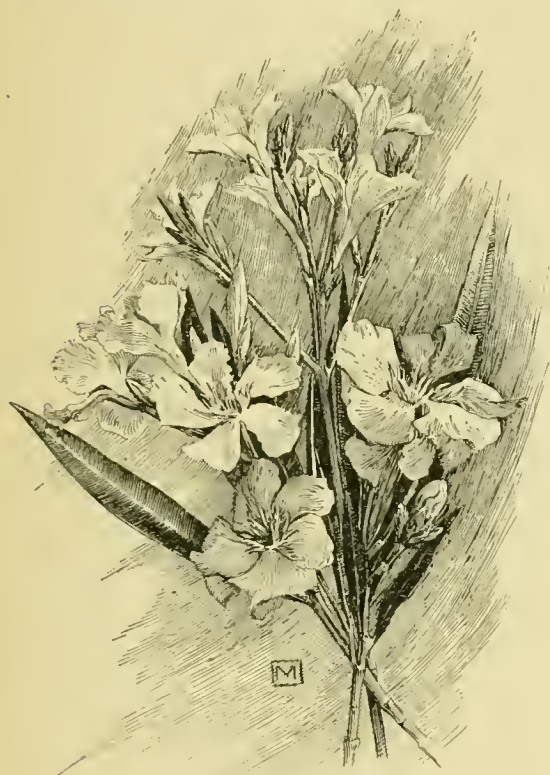
Oleanders are erect glabrous shrubs: lvs. in whorls of 3, rarely 4 or 2, narrow, leathery, transversely feather-veined; fls. showy, rose-red, white or yellowish, in terminal cymes; calyx with many glands inside at the base; corolla-tube cylindrical at the base; throat bell-shaped and containing 5 wide or narrow teeth; lobes twisted to the right; anthers 2-tailed at the base and tapering at the apex into a long thread-like appendage; style 1; ovaries 2, forming pods; seeds twisted.—Species probably 3, with varieties. Medit. region to Japan.

The common species, so very widely cultivated, is *N. Oleander*. It attains 7 to 15 feet, and blooms in summer, the flowers being salver-shaped, five-lobed when single, $1\frac{1}{2}$ to 3 inches across, and commonly pink or white, though the colors range from white through creamy white, blush, rose and copper-color, to crimson and dark purple, with variegated forms. It is of easy culture, and is well adapted to city conditions. The chief troubles are scale and mealy-bug. The scale should be sponged off; the mealy-bug is easily dislodged by the hose. Sometimes a plant forms buds which open poorly or not at all. This is often due to the imperfect ripening of the wood. The flowers are borne on the growth of the year, which should be well ripened in June in order to set many strong buds. For this purpose give the plants plenty of light and air, and water more sparingly when the vegetative growth seems to be finished. After flowering, give the plants less water. Protect them from frost in winter; keep them, if necessary, in a light shed. In April, prune back the old wood which has borne flowers and give more warmth and water. The ripened leading shoots can be rooted in a bottle of water. Oleanders are poisonous, and some persons have died from carelessly eating the flowers. Cattle have been killed by eating the foliage. It is said that in California the oleander is immune from the depredations of the gopher.—*Oleanders in the East* (H. A. Siebrecht): The following method of oleander culture has been pursued by the writer with success. Propagation is performed after the flowering period. Good-sized cuttings are taken, and every one grows. When rooted, the cuttings are potted in small pots and kept barely alive over the winter. They will need scarcely more attention than geraniums until February or March, or whenever growth becomes more active. Later in the spring, the young oleanders are planted outdoors in the open ground, in good rich loam or garden soil. (This is sometimes done with ivies or evonymus, but the common method is to plunge the pots outdoors during summer.) Take up the oleanders in September, pot them and bring them indoors for their second winter. The following spring the plants will bloom; but they will not be shapely. The time has now arrived to train them, either as bush plants or crown standards. Top them at whatever height is desired, say 2 or 3 feet, and the plants will make good crowns the same season (i.e., their second summer). Do not allow the plant to bloom the following spring (which is its third spring), and the result will be a fine specimen in full flower for the fourth summer.—*Oleanders in California* (Ernest Branton): Oleanders are much grown in southern California, and would be extremely popular were it not for black and other scales, which seem to prefer them to everything else. We have five colors here, perhaps all of the same species—white, light pink, dark pink, scarlet and buff. Most of these colors, if not all, can be had in both single and double forms. The writer has never seen an oleander more than 20 feet high, but he thinks they will grow larger. One Los Angeles man planted the red variety twenty-seven years ago for sidewalk trees. (For this purpose, if cleaned of scale when necessary, the oleander is one of the very best.) The trees are heavily pruned and topped every third

year. They are now 12 feet high and 6 to 8 inches in diameter at base. Oleanders need no attention here, and are as readily propagated from hardwood cuttings as willow. They are very floriferous, and the inflorescence comes out in large heavy heads, necessitating a close pruning to make them self-supporting.

A. Fls. not scented.

Oleánder, Linn. (*N. laurifórmis*, Lam.). **OLEANDER**. **ROSE BAY**. (Another plant called "Rose Bay" is *Epilobium angustifolium*.) Fig. 2476. Lvs. in 2's or 3's, lanceolate: appendages of the anthers scarcely protruding; segms. of the crown 3-4-toothed. Medit. region, Orient. Gn. 51, p. 81 (fine trees in vases). A.F. 10:265 (Bermuda shrub with a spread of 25 ft.). L.B.C.



2476. Spray of oleander—*Nerium Oleander*. ($\times \frac{1}{2}$)

7:666 (var. *Loddigesii*, with a variegated fl. and the appendages entire, ovate and obtuse). *N. album*, *N. atropurpureum*, *N. carneum* and *N. roseum*, Hort., are doubtless varieties. The plant is common in subtropical and tropical countries, sometimes planted in hedges, and sometimes runs wild.

AA. Fls. scented.

odórum, Soland. **SWEET-SCENTED OLEANDER**. Stout erect shrub: lvs. in 3's, linear-lanceolate: fls. rosy pink, 2 in. across, in clusters of as many as 80, fragrant; appendages of the anthers protruding; segms. of the crown 4-7, long and narrow. Persia, India, Japan. B.R. 74 (fls. double). B.M. 1799 and 2032. G.C. III. 50: suppl. July 8, 1911.—A less robust plant with lvs. commonly narrower and more distant, and angled branches. In wild plants the calyx-lobes of *N. Oleander* are spreading; of *N. odorum* erect. It has the same range of color as the above, and single and double forms. Prop. by layers or cuttings.

WILHELM MILLER.

NERTÈRA (Greek, *lowly*; referring to the habit). *Rubiaceae*. Creeping herbs, of which one is grown for its handsome profuse berries.

Nerteras are slender perennials, with small opposite lvs. which are stalked or not, ovate or ovate-lanceolate, glabrous or somewhat pilose; stipules present: fls. axillary or terminal, hermaphrodite, inconspicuous, sessile; corolla 4- or 5-lobed; stamens 4 or 5, inserted in base of tube of the tubular or funnel-shaped corolla, the anthers exserted; ovary 2-celled: drupe 2-seeded (two 1-seeded pyrenes), fleshy.—Species about 8, widespread in the southern hemisphere.

depressa, Banks & Soland. **BEAD-PLANT**. Glabrous: variable in size, sometimes forming patches: sts. 6-10 in. long, 4-cornered: lvs. 2 lines long, broadly ovate, acute or obtuse, leathery or almost fleshy; petioles about as long as the blades; stipules very small: fls. solitary, greenish. B.M. 5799. F.S. 21:2167 (charming). F.W. 1875:257.—The bead- or coral-bead-plant is a hardy perennial alpine or rock-plant which forms a dense mat of foliage covered with orange-colored translucent berries the size of a pea. It ranges throughout the Andes, from the tropics to Cape Horn. It also inhabits Tristan d'Acunha, and the mountains of New Zeal. and Tasmania. It is prop. by seed or division. The plant needs a sandy soil, with some leaf-mold, and prefers shade in summer and may need some winter covering in the N. It makes a good house plant and well-fruited specimens are occasionally used abroad in fancy bedding as a novelty. The fr. may last from midsummer well into the winter. In S. Calif., *N. depressa* grows well in the open if it is kept moist and does not receive the direct rays of the sun.

WILHELM MILLER.
L. H. B.†

NERVÍLIA (name refers to the nerved lvs.). *Orchidaceae*. By some authors made a section of *Pogonia* with fl.-scape bearing only scales and not lvs., the foliage coming later and separately, stigma broad and lip elongated: the small grayish or reddish fls. are sometimes solitary or twin but usually in a short raceme, nodding: lvs. radical, usually broad, sometimes colored or marked. The species are about 20, from Trop. Afr. to China. They are very little known in cult.

NESÆA: *Decodon*.

NETTLE: *Urtica*. Dead N.: *Lamium*. False N.: *Boehmeria*. Tree N.: *Celtis*.

NEUWIËDIA (named for Prince Maximilian von Newied). *Orchidaceae*. A half-dozen Malayan terrestrial orchids with short caudex and leafy sts.: lvs. lengthened, stalked, strong-nerved: fls. small, mostly white or yellow, sessile or nearly so, in a bracteate terminal raceme or spike; sepals and petals free and mostly similar, connivent or spreading; lip somewhat spatulate, similar to petals; column short. Little cult.; require conditions of warmhouse paphiopedilum. *N. Lindleyi*, Rolfe, has primrose-yellow decurved fls. 1 in. long: 3-4 ft.: lvs. many, 1-2 ft. long, oblanceolate, membranaceous. B.M. 7368. *N. Griffithii*, Reichb. f., has white deflexed pubescent fls. in a short spike; 16 in.: lvs. 4-10 in. long, elliptic-lanceolate, acuminate. B.M. 7425.

NEVIÛSIA (after Rev. R. D. Nevius, who discovered it). *Rosicæae*. **SNOW WREATH**. Ornamental shrub sometimes planted for its white flowers.

Deciduous: lvs. alternate, petioled, doubly serrate, stipulate: fls. perfect, in clusters or solitary; calyx-tube flattish; sepals 5, petal-like, spreading, incisely serrate; petals 0; stamens numerous, longer than the sepals, persistent; carpels 2-4, styles slender, curved at the apex, slightly shorter than the stamens: fr. consisting of drupe-like achenes inclosed by the persistent calyx.—One species, found only in Ala. near Tuscaloosa and

on Sand Mt. A very distinct genus allied to *Kerria* and *Rubus*, well distinguished by its apetalous fls.

The snow wreath is a low or medium-sized shrub with slender wand-like branches, bright green generally ovate leaves and white feathery flowers in clusters arranged wreath-like along the branches. It does not seem perfectly hardy north of Philadelphia though it can be grown as far north as Massachusetts in sheltered localities; and it produces flowers on the young growth, if partly killed back.

Even South it does not develop in every situation its full beauty which earned it the name "snow wreath" its flowers are likely to be greenish or dirty white instead of snowy.

It is therefore not a plant to be recommended for general planting. If forced in the greenhouse the flowers come out always pure white, and covered with its feathery blossoms it is an object of great beauty. It likes a loamy and well-drained soil and a warm sheltered position.

Propagation is by greenwood cuttings under glass, and by seeds.

alabamensis, Gray. Shrub, 3-6 ft.: branches terete: lvs. ovate to oblong-ovate, acute or acuminate, doubly serrate, minutely pubescent while young, finally nearly glabrous, 1-3 in. long; fls. in clusters of 3-8, rarely solitary, about 1 in. across. June, July. B.M. 6806. G.C. III. 35:229; 41:41. G.M. 53:315. G. 26:135.

ALFRED REHDER.

NICÁNDRA (Nícaander, poet of Colophon, wrote on plants about 100 B.C.). Syn. *Physalodes*. *Solanácea*. One Peruvian herb differing from *Physalis* chiefly in the 3-5-lobed ovary and dry rather than fleshy fr., and in the larger and more showy fls., of which the corolla is nearly entire. Lately a second species has been described, perhaps a variant.

Physalodes, Pers. (*Átropa physalodes*, Linn. *Physalodes peruvianum*, Kuntze. *N. physalodes*, Gaertn.). Known as APPLE-OF-PERU, a strong spreading annual, 3-4 ft. high, grown for the showy blue fls. and odd frs.: glabrous; lvs. elliptic or elliptic-ovate, sinuate and toothed, narrowed into a prominent petiole; fls. solitary in the axils, on recurving pedicels, an inch or more across, shaped like a potato flower, the corolla blue or bluish; fr. a thin-walled and nearly or quite dry berry, enclosed in an enlarged, strongly 5-winged calyx. B.M. 2458.—The apple-of-Peru is an old-fashioned garden annual, now rarely seen. It has escaped from cult. in some places in the U. S., and it is now widely distributed in the tropics. It is often confounded with the ground cherry and alkekengi, which are species of *Physalis*.

N. violacea, André. Vigorous branched annual, glabrous or sometimes the lvs. hairy on upper side; lvs. subtriangular, the petiole reaching 10 in. long and 5 in. broad, coarsely toothed or lobed; fls. solitary, axillary and short-pedicelled; calyx large, dark violet on lower half, the lobes cordate; corolla violet-blue above and white on lower half, campanulate, to 1½ in. broad. Probably

S. Amer. R.H. 1906:208.—Distinguished from *N. Physalodes* particularly by the prominently blue corolla and calyx and similar color on the sts., petioles and peduncles, and the scattered colored hairs on upper surface of lvs.

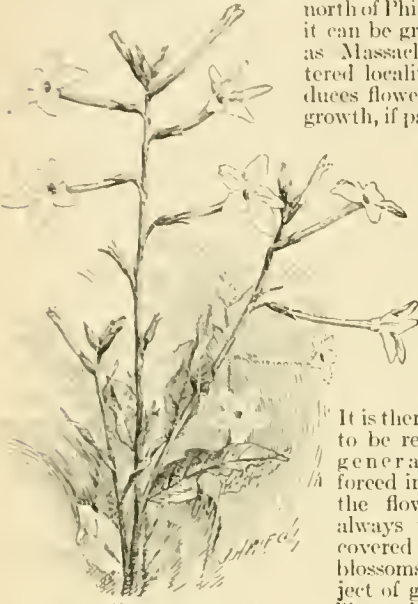
L. H. B.

NICOTIÀNA (named for Jean Nicot, 1530-1600, of Nismes in Languedoc, consul from the King of France to Lisbon, Portugal, in 1560, who obtained tobacco from a merchant of Flanders, Belgium, which he presented to the court of Portugal and also, on his return to France, to the Queen Catherine de Medici). *Solanácea*. Herbaceous annuals, perennials or rarely shrubby or arborescent, comprising several stately plants, valued for their rapid growth and large foliage; other species produce showy flowers, and are popular flower-garden subjects; one is the tobacco.

Herbs, mostly viscid-pubescent, of strong odor, possessing narcotic poisonous properties: lvs. alternate, never compound, entire or undulate, mostly sessile or nearly so by a tapering base; fls. hermaphrodite, often regular, long-tubular, mostly opening at night and most fragrant then, in terminal racemes, panicles or thyrses; calyx usually persistent, inclosing the fr., tubular-campanulate or ovoid, 5-parted; corolla salverform, funnelform, or tubular-swollen; limb plicate in the bud, 5-lobed; stamens 5, inserted on the tube, unequal or nearly equal, included; filaments straight, anthers longitudinally dehiscent, ovate or oblong; ovary 2-celled, or 4-celled in one species; ovules many; placenta axillary; style simple; stigma capitate; fr. a 2-4-celled caps., but usually splitting into 4 to several valves; seeds numerous, minute, oblong, somewhat kidney-form, roughened or pitted.—A genus of about 45 species and 54 subspecies, mostly of Trop. Amer., with a few from N. and S. Amer. and 1 from Austral.

Latest publications: Comes, "Monographie du genre Nicotiana," 1899; Splendore, "Sinossi descrittiva ed iconografia dei semi del genere Nicotiana," 1906; Setchell, "Studies in Nicotiana," 1912; "Tobacco-culture," United States Department of Agriculture, Farmers' Bulletin No. 571, 1914.

Nicotianas are easily cultivated, but in northern latitudes require a hot exposure and a deep rich loose loamy soil, rich in lime and potash, both of which may be supplied from wood-ashes. As the seeds grow slowly in cool weather, they should be started in early spring under glass and kept moist and warm. For tobacco, in districts farther north, hot-beds will secure rapid growth, but in other localities coldframes with a southern exposure should be used. The soil should be a loose loam of high fertility, and thoroughly drained. In the fall, forty pounds of lime and two hundred pounds of stable-manure to 100 square feet of bed should be turned under. In the spring, about two weeks before sowing the seed, twenty pounds of cottonseed-meal or castor pomace, one pound of acid phosphate, and one-half pound of carbonate or sulfate of potash to 100 square feet of bed-area should be



2477. *Nicotiana glauca* var. *grandiflora*.



2478. *Nicotiana glauca* var. *grandiflora*, commonly known as *N. affinis*. (× 1½)

thoroughly spaded into the soil to a depth of 4 or 5 inches, and the bed-surface finely pulverized. If possible, the soil should then be sterilized with steam to prevent fungous diseases and the growth of weed seeds. The seed should be sown at the rate of an even teaspoonful of dry seed to 100 square feet of bed. In order to secure an even distribution of the seed, it is thoroughly mixed into two quarts of land-plaster, finely sifted wood-ashes or bone-meal. Three sowings should be made to insure an even distribution over the bed, the light color of the filler material serving to indicate the evenness of the distribution. The seed must be covered by going over the bed with a roller, or packing with a plank. When young, nicotianas will stand considerable frost, but become more sensitive with age. They are well adapted to pot or tub culture and are fine for summer porch-decoration. *N. alata*, best known in the trade as *N. affinis*, and *N. Sanderae* are the most popular flower-garden plants. Of the larger species for subtropical bedding, *N. glauca*, *N. tomentosa*, and *N. Tabacum* are best.

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A. Fls. racemose, paniculate, or axillary, extra-axillary, and solitary; corolla salverform, white or colored; tube long, cylindric; limb-segms. obtuse or acute: (Nos. 1-9. Subgenus *Pectunioides*.)

B. Ovary 2-celled.

c. Lobes of corolla acute.

D. Color of corolla greenish to purplish or lobes only white.

E. Corolla 6-7 times longer than the calyx.

1. *longiflora*, Cav. Erect annual or perennial, 2-3 ft. tall; st. slender, bristly-scabrous; lvs. somewhat clasping, spatulate to lanceolate, prominently undulate, obtuse or acute; fls. 4 in. long, extra-axillary in terminal loose racemes; calyx striate, tubular-campanulate, 5 unequal, erect, linear-lanceolate teeth; corolla villous, salverform, night-opening, fragrant, nearly 7 times longer than the calyx; tube slender, swollen above, green or pale violet; lobes $\frac{1}{2}$ in. long, yellowish violet without, white within, nearly equal, ovate-lanceolate, obtuse, often emarginate; filaments adnate, near the throat unequal, 1 shorter; anthers yellowish violet; style shorter than the stamens; caps. nearly equaling the calyx. Texas to Chile and Argentina.—Rare in cult., and inferior to *N. alata*. Becomes annual in northern gardens.

EE. Corolla 4-5 times longer than the calyx.

2. *alata*, Link & Otto (*N. decurrens*, Agardh). Herbaceous, perennial; st. erect, slender, 2-3½ ft. tall, branching; lvs. sessile, decurrent, oblong-spatulate to ovate-elliptic; apex obtuse, or acute to nearly acuminate; margin entire or distantly repand-dentate; fls. spreading in an open raceme; calyx hirsute, tubular, with 5 unequal subulate teeth; corolla villous, night-opening, fragrant; tube slender, yellowish green, 4-5 times longer than the calyx, swollen above; limb oblique, nearly 2 in. across, pale violet beneath, white within; lobes ovate, acute, often emarginate; stamens unequal, not exserted; style exserted; caps. oblong, shorter than the calyx. Brazil, Uruguay, and Paraguay. Gt. 1010. It is doubtful whether the species *N. alata* is in cult., the garden forms being the varieties. Var. *persica*,

Comes (*N. persica*, Lindl.). Lower lvs. subpetiolate, oblong-spatulate, base often subcordate, repand above, all somewhat clasping and auricled or decurrent; corolla-tube shorter, limb greenish yellow without, lobes slightly unequal, emarginate. Brazil. B.R. 1592.—Intro. into the U. S. as early as 1906. Not much cult. Var. *grandiflora*, Comes (*N. affinis*, T. Moore, under which name it is universally known in gardens). Figs. 2477, 2478. Fls. very large, and very sweet-scented; tube much dilated, limb yellowish without. G.Z. 1882: 253-5. G.C. II. 16:141. Gn. 34, p. 520; 42, p. 126; 50, p. 212; 56, p. 384. Gng. 5:182. G. 27:323.—Known only in cult. An extremely popular plant, blooming freely throughout the season until killed by frost. On account of its slender habit, it should be planted in a place protected from strong winds. It is apparently perennial, but is treated as a half-hardy annual. It self-sows, and often maintains itself from year to year in the Middle States and the S. In the warmer parts of



2479. A good border effect with *Nicotiana*.—*N. sylvestris*.

the S., the roots live over winter with a little protection. Fall-sown seedlings make excellent pot-plants in the winter, the fls. opening in the early evening and closing in the morning, and are very fragrant.

DD. Color of corolla entirely white.

3. *sylvestris*, Spegaz. & Comes. Figs. 2479, 2480. Herbaceous, perennial, glandular-pilose throughout; st. tall, leafy below, branching above; lvs. sessile, broad, oblong-spatulate; the lower dilated at the base, half-clasping and auricled, slightly decurrent, the apex, rotund or obtuse; the upper acute, margin reflexed; fls. drooping, in short racemose panicles; pedicels nearly equaling the calyx; calyx 5-angled, somewhat swollen, short and unequally toothed, teeth ovate-acute; corolla white, fragrant, salverform, pilose; tube 6-7 times longer than the calyx, above somewhat inflated; limb white within; lobes nearly equal, ovate-triangular, often emarginate, becoming reflexed. Argentina. G.C. III. 26:357. G.W. 7:230; 12:318. A.F. 24:600. G.M. 52:48. Gn. 59, p. 186. Gn.W. 15:442.—The lvs. are rugose, veiny, and more attractive than in *A. alata* but the limb of the fl. is less oblique, the tubes more swollen

and does not close in the morning on cloudy days. One of the novelties in 1899 and 1900.

DD. *Color of corolla rose.*

1. *Sänderæ*, Hort. Sander (*N. alata* × *N. Forgetiāna*). Herbaceous, annual, viscid-pubescent: sts. 2-3 ft. tall, of bushy habit; basal lvs. large spatulate, undulate; st.-lvs. oblong-lanceolate, short-petioled, acuminate, undulate; fls. bracteolate, in large loose panicles; corolla salverform; tube cylindric, 3 times the length of the calyx, swollen above, greenish yellow tinted with rose; limb oblique; lobes elliptic, acute, often emarginate, carmine-rose. Originated in 1903 by Sander & Sons, St. Albans, England, as a cross between *N. alata* and *N. Forgetiāna*. A.G. 25:483. F.S.R. 2:216. F.E. 20:434. G. 26:141; 27:321. G.C. III. 34:256; 39:61. G.M. 47:578; 48:465. Gn. 67:16. G.W. 8:559. R.B. 31:25. R.H. 1905:16.—An attractive and popular garden plant intro. into U. S. in 1904.

CC. *Lobes of corolla obtuse or rounded.*

D. *Lvs. petioled.*

5. *acumināta*, Hook. (*Petunia acumināta*, Graham. *P. viscōsa*, Miers. *N. diversifolia*, Nees?) Herbaceous, annual, viscid-pubescent: st. slender, branching; lvs. ovate-lanceolate, undulate, sometimes subcordate, narrowed into a short petiole, apex long-acuminate; fls. loose-racemose; calyx glandular-pubescent, membranaceous-scarious, 5 nerves ending in narrow, linear, unequal teeth; corolla white, about 3 in. long; tube green-veined, slightly curved, swollen above, nearly 5 times as long as the calyx; limb 5-parted; lobes small, obtuse, emarginate expanded, green-veined without; caps. nearly equaling the calyx. Chile. B.M. 2919.—Not common in cult., under which it appears to be annual, but in its native habitat it is perennial.

DD. *Lvs. sessile.*

E. *Fls. rose-colored.*

6. *Forgetiāna*, Hort. Sander. Herbaceous, annual; st. 2-3 ft. high, branching from the base; lvs. papery, soft, pubescent; basal lvs. oblong-lanceolate, largest about a foot long, obtuse, tapering to a winged petiole, slightly undulate; st.-lvs. similar, but smaller, ovate, with decurrent blades; fls. in broad loosely branched panicles; branches slender, glandular-pubescent; lower bracts leafy, narrow, acute, becoming smaller upward; pedicels slender, shorter than the fls.; calyx small, 5-toothed, covered with stiff hairs; teeth unequal, very slender, rigid; corolla narrow, funnelform, 1-1¼ in. long, 1 in. diam.; sparsely hairy; lobes of the limb nearly equal, triangular, obtuse; stamens included; filaments hairy at base, jointed above their attachment to the corolla; ovary glabrous. Brazil. B.M. 8006.—Intro. into cult. about 1901 but not much in the trade, being used mostly in hybridizing.

EE. *Fls. greenish.*

F. *St. pubescent throughout.*

7. *noctiflōra*, Hook. (*N. longiflōra noctiflōra*, Voss). Herbaceous, perennial, glandular-viscid, hairs appressed: st. 2-3 ft. tall, slender, branching; lvs. petiolate, oblong-lanceolate, sinuate or undulate-plicate, the lower oblong-obtuse, the upper nearly sessile, linear-lanceolate, acute; fls. pedicellate, horizontal, in terminal panicles; calyx tubular, with 5 unequal, narrow, lanceolate, acute teeth; corolla salverform, night-opening, fragrant, greenish purple without, white within, 3-4 times longer than the calyx; tube cylindric; lobes equal obcordate, emarginate, oblong; nectar-ring orange, thickened; caps. longer than the calyx. Argentina and Chile. B.M. 2785. Var. *albiflōra*, Comes, has the fls. nearly glabrous, glaucous, and greenish white or sometimes pure white without instead of purplish, or sometimes with a purplish vein in each corolla-lobe. Argentina.—Very decorative. Intro. into U. S. from Italy in 1908.

FF. *St. glabrous above.*

8. *suavēolens*, Lohm. Herbaceous, annual or biennial, usually viscid: st. 1-2 ft. tall, densely villous at base, glabrous above; lvs. at base subpetiolate, spatulate, obtuse, above ovate-lanceolate, acute, undulate, petiole decurrent, the uppermost nearly sessile or clasping, acuminate, villous; fls. pedicellate, nodding, distant, bracteolate, in terminal racemes; calyx 5-toothed, striate, tubular, pubescent; teeth linear-lanceolate, narrow, acuminate, unequal; corolla greenish purple, night-opening, fragrant, pubescent, salverform; tube slender, cylindric, striate, 4 times longer



2480. *Nicotiana sylvestris*. (×¼)

than the calyx; limb purplish without, white within; somewhat 2-lipped, the upper lobes very small, all subrotund, obtuse or emarginate; caps. ovate, obtuse, nearly equaling the calyx. Austral.—It is said to grow in moderate shade. Var. *undulāta*, Comes (*N. undulāta*, Vent., not Ruiz & Pav.). The plant is taller; lvs. large, undulate; fls. larger. B.M. 673. Var. *macrānthā*, Comes (*N. frāgrans*, Bern.). The st. is glabrous; lvs. oblique, subcordate-ovate, sinuate-repand, acute; corolla large, white, mouth expanded; lobes obtuse. B.M. 4865.

BB. *Ovary 4- to many-celled.*

9. *quadrivālis*, Pursh. Herbaceous, annual, viscid-pubescent: st. erect, or branching; lvs. 4-6 in. long, petiolate, oblong, the upper nearly sessile, entire, lanceolate, acute; margin often somewhat revolute; fls. few on short slender pedicels; calyx-teeth linear, corolla tubular, swollen below, tube about 1 in. long; limb 1½ in. diam.; lobes ovate, obtuse, dark purplish without, white within; caps. 4-celled, subglobose, nearly equaling the calyx.—Formerly cult. by the Indians and still grown by them to a slight extent; probably does not occur outside Indian cult. and gardens; possibly only a cult. mutant of *N. Bigelovii*, as it appeared in Setchell's pedigree cultures of that species. Fresh lvs. said to smell like a goat, but the odor disappears on drying. *N. multivālis*, Lindl., known only from Indian cult. in Ore. and Wyo., differs in the many-celled indehiscent caps., and many-lobed corolla-limb.

AA. *Fls. racemose or paniculate; corolla salverform; tube relatively broad or swollen, usually yellow or mixed with white or red; limb-segms. obtuse or acute. (Nos. 10-17. Subgenus Rustica.)*

B. *Plants glabrous and glaucous.*

10. *glauca*, Graham (*N. arborea*, Dietr.). Erect, tree-like, up to 20 ft. tall, glaucous-blue all over: st. branching: lvs. long-petioled, unequally subcordate-ovate, acute, somewhat repand; fls. pedicelled, pedicels incurved in fr., in loose, terminal, bracted panicles; calyx tubular, 5-toothed, teeth acute, unequal, somewhat ciliate; corolla yellow, tube scarcely incurved, somewhat swollen above; mouth contracted, softly woolly; limb small, lobes ovate, very short, acute; caps. inclosed in the calyx. Argentina, Paraguay, Bolivia. B.M. 2837. G. 26:571.—Frequently cult. for its stately habit and striking glaucous-blue foliage which sometimes develops purplish tints. It has escaped from cult. and runs wild in Texas and Calif. Usually does not bloom in the northern states. Easily grown from seed.

BB. *Plants pubescent.*

c. *Lvs. sessile.*

D. *Corolla not over 3 times longer than the calyx; stamens much exserted.*

E. *The corolla without a bright red margin.*

11. *tomentosa*, Ruiz & Pav. (*N. colossæa*, André). Herbaceous or woody, perennial, viscid-pubescent: st. reaching 10 to 20 ft., diffusely branched from the base upward; branches leafy, terete, ascending: lvs. 10-18 in. long by 4-6 in. wide, obovate-oblong, acuminate, narrowing into a very broad undulate, winged petiole with a clasping base, pale green above, paler beneath, with conspicuous midrib and veins; panicle terminal, nearly a foot long and broad, branches ascending, loose-fl., tubercled at the articulations of the pedicels; bracts narrow, caducous; pedicels $\frac{1}{2}$ - $\frac{2}{3}$ in. long; fls. inclined, $1\frac{1}{2}$ in. long; calyx broadly terete, $\frac{1}{2}$ in. long, smooth, green, base rounded; lobes unequal narrow, obtuse, shorter than the tube; corolla slightly incurved, pale green and pubescent without; tube somewhat exceeding the calyx-lobes; lobes ovate, obtuse, spreading, yellowish tinged with red within; stamens suberect, twice as long as the corolla-lobes; ovary conical, glabrous; style longer than the stamens, reddish; stigma 2-lobed. Brazil. B.M. 7252. G.C. III. 9:83. Gng. I: 97.—A remarkably valuable plant for large and rapid growth. Very useful in making subtropical effects. Re-described by André from plants that came up in soil received with Brazilian orchids which were sent to France. It began to attract attention in France about 1899. It usually has reddish sts. which add to the bold effect. Seeds should be started under glass. Var. *variegata*, Hort., has mottled and margined foliage. R.H. 1893, p. 9. G.M. 37:61.

EE. *The corolla with a bright red margin.*

12. *isodendra*, Rieker (*N. arborea semperflorens*, Ament. *N. colossæa variegata* $\times$ *N. macrophylla*). A tree-like perennial herb, viscid-pubescent throughout: st. erect, 6-18 ft. tall, somewhat branching above: lvs. sessile, ovate to elliptic, acute, undulate: fls. in loose, long-pedicelled, terminal panicles, drooping; tubes greenish, 2 or more times the length of the calyx; corolla broader and whiter than in *N. tomentosa* with a bright red margin. A hybrid between *N. tomentosa variegata* and *N. Tabacum macrophyllum* originated in Germany in 1903 by Franz Ament. It is poorly described and as yet little known in the U. S. M.D.G. 19:208. Gt. 54, p. 43.—Flowers continually throughout the season.

DD. *Corolla 4 times longer than the calyx; stamens slightly or not at all exserted.*

13. *Lángsdorffii*, Weinm. Herbaceous, annual, pilose to downy: st. 2-3 ft. tall, branching: lower lvs. ovate

with a short narrow petiole, undulate, obtuse; upper lvs. ovate-elliptic or somewhat lanceolate, sessile, decurrent, acute: fls. paniculate, drooping; calyx 5-toothed, upper teeth longest; corolla greenish yellow, salverform, the tube clavate and swollen above, 3 times longer than the calyx; limb yellow within, obsoletely 5-lobed; lobes obtuse, somewhat emarginate: caps. obtuse, slightly longer than the calyx. Brazil and Chile. B.M. 2221, 2555.

cc. *Lvs. petiolate.*

D. *Corolla 2-3 times longer than the calyx.*

E. *Fls. yellowish or greenish.*

F. *Plants up to 6-7 ft. tall, robust with large heavy lvs.*

14. *wigandioides*, Koch. Herbaceous, perennial, of shrubby habit, glandular-pubescent: st. erect, 6-9 ft. tall, somewhat branching below: lvs. petiolate, ovate, acuminate, undulate: infl. paniculate; fls. pedicelled, drooping; calyx campanulate, teeth unequal, acuminate, glandular-pubescent; corolla salverform, yellowish white; limb somewhat reflexed; lobes broadly ovate, cuspidate; stamens included, filaments tomentose at base; style clavate; stigma green; ovary conical, ring fleshy, reddish, surrounding the base. Sent to the Cracow Botanical Garden from Colombia about 1852 by Warszewicz. B.H. 23:331.—A very striking plant for bold tropical effects.

FF. *Plants not over 4 ft. tall, slender and smaller-lvd.*

15. *rustica*, Linn. Herbaceous, annual, sometimes bi- or triennial, somewhat viscous pubescent: st. about 3 ft. tall, branching below: lvs. petiolate, large, thickened, ovate or oblong, cordate or subcordate, entire or rarely undulate, obtuse: fls. day-opening, pedicellate, in terminal racemes, yellowish or greenish, about 1 in. long; tube cylindric, inflated above, contracted at the throat, slightly villous, 2-3 times longer than the calyx; limb glabrous, yellowish; lobes short, rounded: caps. ovate to subglobose, apex often somewhat umbilicate. Mex. and Texas. Barton, Fl. 1:25.—Said to be the first species of tobacco intro. into Eu. Its use was made known by John Nicot for whom the genus was named.

EE. *Fls. reddish yellow.*

16. *glutinosa*, Linn. Herbaceous, viscid-pubescent throughout: st. angular above: lvs. petiolate, subrotund to ovate, cordate, abruptly acuminate: fls. in terminal racemes, drooping, bracteolate; calyx somewhat 2-hipped, lower lobe 2-parted, upper lobe 3-parted, teeth lanceolate-acuminate, the upper largest, rather long, recurved; corolla reddish yellow, viscid-pubescent without, twice longer than the calyx; tube incurved, swollen above; limb 5-parted; lobes ovate, acute: caps. ovate, obtuse, included within the calyx. Peru and Bolivia. And. Bot. Rep. 484.—Intro. into the U. S. from Italy in 1908.

DD. *Corolla 5-6 times longer than the calyx.*

17. *paniculata*, Linn. Herbaceous, annual, viscid-pubescent: st. 2-3 ft. tall, simple, angular above, branching: lvs. petiolate, subcordate, ovate or suborbicular, obtuse or abruptly apiculate, the upper ovate, acute: fls. pedicellate, bracteolate, in large terminal panicles; calyx with 5 nearly equal linear teeth; corolla yellowish green, salverform, tube clavate, glabrous, nearly 6 times longer than the calyx, contracted at the throat; limb plicate, green, very short, becoming revolute; lobes acute: caps. ovate, obtuse, slightly longer than the calyx. Peru. R. & P. Fl. Peruv. 129.—Not much cult.

AAA. *Fls. in panicle corymbs; lobes acute; corolla funnel-form, throat more or less inflated, red or rarely white. (Subgenus Tabacum.)*

18. *Tabacum*, Linn. TOBACCO. Herbaceous, annual, sometimes bi- or triennial and somewhat shrubby at

base, viscid-pubescent: lvs. thin, half-clasping, somewhat auricled, sessile, more or less decurrent, ovate, oblong, elliptic or lanceolate; fls. pedicellate in bracted panicles or racemes; calyx oblong, teeth unequal; corolla woolly without, 2-3 times longer than the calyx; tubes white or whitish; limb drooping, rose-colored or red; lobes acute or acuminate; caps. nearly equaling the calyx. Trop. Amer. Nees Fl. Germ. 24:461.—The fls. are diurnal. Cult. from earliest times by the Indians and often runs wild. Its commercial cult. being an agricultural subject is not discussed in this work. It is a striking plant in the garden. Var. *angustifolia*, Comes (*N. chinensis*, Fisch.). This is a narrow-lvd. variety from China and Java of which there are several hybrids. Intro. into the U. S. in 1906. Var. *macrophylla*, Schrank. A large-lvd. variety with large red fls., of which there are several horticultural forms, variously listed in the trade as *N. grandiflora purpurea*, *N. atropurpurea grandiflora*, *N. rubra*.

N. Bigelovii, Wats., with sts. 1-2 ft. tall, fls. white 1-2 in. long, is of interest as being the possible origin of *N. quadrivalvis* and *N. multivalvis*. Calif.—*N. trigonophylla*, Dunal, has sts. 15 in. tall: lvs. triangular, sessile, somewhat clasping, 2-2½ in. long, ½-¾ in. wide; corolla yellowish green, ½-¾ in. long; viscous pubescent throughout. Utah to Mex. and Calif.

P. L. RICKER.

NICOTÛNIA is a name given by the undersigned to hybrids of *Nicotiana* and *Petunia* offered in 1893. They were originally described as follows: "The plants have slender, drooping or trailing tomentose green, red and purple stalks and lvs. twice or three times as large as the *petunia*; the fls. are handsome, white, pink, carmine or striped and borne in plenteous profusion. No seed is ever produced, but they are very readily multiplied by cuttings."

These plants have unfortunately vanished from cult. They were, of course, annuals. They were semi-trailing plants, the lvs. covered with abundant short, woolly hairs. The cross was *Petunia hybrida* var. *grandiflora* × *Nicotiana wigandoides* var. *rubra*, the former probably being the seed-parent. The singular thing about the cross was the fact that the root seemed in all cases to be paralyzed and very defective, though the tops in all the many hybrids produced grew with much vigor. The blooms were beautiful, and it is a pity that the plants were not grafted on tobacco roots. Subsequently several parties have reported crosses of the tobacco and *petunia* and also tobacco and *salpiglossis*.

LUTHER BURBANK.

NIDULÂRIUM (from Latin *nidus*, a nest). *Bromeliacea*. Warmhouse epiphytes, requiring the treatment of billbergia.

Flowers perfect, borne in compound heads, the petals joined at the base and not ligulate (in all the typical species); anthers attached mostly on the back (in some related plants attached mostly at the base): lvs. strap-shaped, ovate or oval, in dense rosettes, the fls. mostly sessile, red, blue, or white; the inner lvs. of the rosette, here called bract-lvs., are usually highly colored and constitute most of the merit of some species.—About 15 Brazilian species, by some referred to *Karatas* and other genera, but by Mez (DC. Monogr. Phaner. 9) kept distinct.

During the spring and summer nidulariums will require plenty of heat and moisture, this being their growing season. About the middle of January or when they show signs of becoming more active, they may be placed in a house with a night temperature of 65°. Before the plants are started up too much, they should have any necessary repotting. They do well in either pans, cribs, or wire baskets. The compost should be some light porous material, such as fern fiber, sphagnum moss, or fibrous peat, adding some broken crocks and charcoal for drainage. Gradually increase the temperature at night until by summer they are having 75° with 10° to 15° higher during the day. Dampen the

walks and under the benches so as to produce plenty of atmospheric moisture. With the increased temperature, do not allow them to become dry at the root, as they like an abundance of moisture. While nidulariums like plenty of light, they will need some shade when the sun is powerful, so they will not burn. After flowering they should be encouraged to make new growth. During the winter the temperature may be dropped to about 60° at night and the atmosphere should be kept drier. They will need only a very little water during the dark days of winter, just enough to keep them alive. Nidulariums are increased by suckers like many others of the *Bromeliaceae*. These may remain on the parent plant until of sufficient size and strength, when they should be taken off and placed in small pots, using the same compost as above. Place these under a frame with bottom heat and a humid atmosphere. In a short time, they begin to make growth, when they may be given the same treatment as the old plants. Sponge often for scale. (J. J. M. Farrell.)

A. Fls. white.

Innocéntii, Lem. (*Karatas Innocéntii*, Ant.). Stemless and stoloniferous: lvs. about 20, in a dense rosette, strap-shaped, about 1 ft. long, broadest near the middle, with many small, spiny teeth, green but more or less tinted brown or red, the oval bract-lvs. bright red; fls. in a dense head, white. I.H. 9:329.—Named for the Marquis de St. Innocent, amateur, of Autun, France. There is a form with yellow-striped lvs. I.H. 41:5. This species is one of the best nidulariums.

striatum, Baker (*N. Makoyanum*, Morr., not Hort. *Karatas neglécta*, Baker). Lvs. 8-12 in. long, strap-shaped, fine-toothed, prominently striped with central bands of white and shading to cream-color toward the margin, the body color deep green and not brown-tinted. G.C. III. 8:183 (desc.).—A good species.

AA. Fls. blue or violet.

Scheremetiévii, Regel (*Karatas Scheremetiévii*, Ant.). Lvs. 10-15, in a short rosette, lanceolate, 10-18 in. long, with many small but conspicuous spiny teeth, rather firm, bright green above and pale green beneath, the bract-lvs. bright red and showy, the points recurving; fls. blue, in a small head. Brazil. Gt. 1858:224.

fulgens, Lem. (*N. pictum*, Hort. *Guzmânia picta*, Lem.). Lvs. 15-20, in a dense rosette, strap-shaped, with large, strong teeth, mottled with green of different shades, paler and scurfy beneath, the bract-lvs. oval and scarlet; fls. blue. J.F. 4:411.

N. amazonicum, Lind. & Andr.=Canistrum.—*N. Bindtii*, Morr.=Aregelia.—*N. Carolinæ*, Lem.=Aregelia.—*N. Chantrieri*, André, is a hybrid of *N. Innocéntii* and *N. fulgens*, with brilliant red bract-lvs., obtained by Chantrier Frères, France. R. H. 1895:452.—*N. Lindenii*, Regel=Canistrum.—*N. mèdeco-pictum*, Hort. Lvs. with dark blotches on a green ground and broad white bands lined with green in the center. Brazil.—*N. Morrinianum*, Makoy=Aregelia.—*N. princeps*, Morr.=Aregelia.—*N. triste*, Regel=Aregelia.

L. H. B.

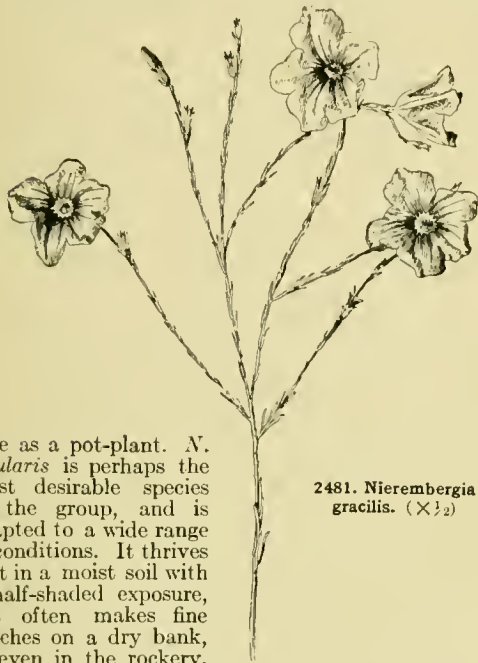
GEORGE V. NASH.†

NIEREMBERGIA (for John E. Nieremberg, 1595-1658, a Spanish Jesuit and first professor of natural history at Madrid). *Solanaceae*. CUP-FLOWER. Mostly tender perennial herbs valued chiefly for the open border or for pot-plants; they are mostly of prostrate habit, with showy pale violet or white flowers borne freely through the summer and autumn.

Stem decumbent or creeping, rarely suberect, diffusely branched, the branches usually slender and nearly glabrous: lvs. alternate, scattered, entire; fls. borne singly on the tips of young shoots, mostly white with a purple center; calyx 5-parted, tubular or bell-shaped; sepals spreading; tube of corolla long, slender, attenuated below, abruptly expanded above into a broad bell-shaped, saucer-shaped or funnel-shaped limb, which has 5 broad, obtuse lobes; caps. 2-valved.—About 25 species from Trop. and Subtrop. Amer., allied to

Petunia and characterized by the long and very slender tube of the corolla.

Several species of *Nierembergia* have distinct value for certain purposes. *N. gracilis* makes an excellent pot- or basket-plant, and is also popular for the border. *N. frutescens* does well in the open, but is more desir-



2481. *Nierembergia gracilis*. ($\times \frac{1}{2}$)

able as a pot-plant. *N. rivularis* is perhaps the most desirable species of the group, and is adapted to a wide range of conditions. It thrives best in a moist soil with a half-shaded exposure, but often makes fine patches on a dry bank, or even in the rockery.

Both *N. gracilis* and *N. frutescens* thrive in a loose, rather moist soil, but are not impatient of dryness. These three species endure winters without protection in the latitude of New York.

Nierembergias are propagated chiefly by cuttings taken in the fall, or by seeds. *N. rivularis* is most readily increased by dividing the creeping stem where it has rooted at the nodes. As most species are tender, they are best stored indoors, a cool greenhouse being best, where they may receive plenty of light and air. It is best to cut them down almost to the soil when setting them away for the winter.

AA. *St. prostrate or creeping; branches ascending.*

B. *Fls. creamy white, sometimes slightly tinted with rose or blue.*

rivularis, Miers. **WHITE-CUP.** Whole plant glabrous: st. slender, creeping, rooting freely at the nodes, forming a dense mat, the branches seldom rising over 6 in. high: lvs. oblong to oblong-spatulate, obtuse membranaceous, variable in size, with a long, slender petiole: fls. sessile or short-peduncled; calyx cylindrical, the lobes oblong-lanceolate, slightly spreading; corolla-limb broadly bell-shaped, 1-2 in. broad; throat golden yellow. La Platte River, S. Amer. B.M. 5608. J.H. III. 31:311. Gn. 23, p. 188; 25, p. 145; 64, p. 113; 66, p. 431. G. 19:33.—A very adaptable and desirable species for a stream bank, dry border or alpine garden. The fls. are large and beautiful. It is difficult to eradicate after once established, as small pieces of the st. will take root and grow.

BB. *Fls. white, with purple center.*

gracilis, Hook. (*N. filicaulis*, Hort.). Fig. 2481. Branches very slender, ascending 6-8 in., slightly downy: lvs. scarcely $\frac{1}{2}$ in. long, linear or slightly spatulate, those on the younger branches somewhat hairy: limb of corolla spreading, convex, white tinged

and veined with purple toward the center, throat yellow. Argentina. B.M. 3108. G. 29:255.—A charming little plant for the hanging-basket. A garden form, var. *Crozyana*, Hort., has fls. tinted lilac and appears to be more floriferous than the type. F.S. 14:1410.

BBB. *Fls. pale lilac.*

Veitchii, Berkeley. St. 8-12 in. long, with slender, glabrous or slightly pubescent branches: lvs. $\frac{1}{2}$ -1 in. long, short-petioled or sessile, the upper linear, the lower broadly spatulate: calyx-lobes linear-oblong, recurved; corolla-tube $\frac{1}{2}$ - $\frac{3}{4}$ in. long, white, the limb broadly bell-shaped, pale lilac. Trop. Amer. B.M. 5599. F. 1872, p. 141.

AA. *St. nearly erect.*

frutescens, Dur. (*N. fruticosa*, Hort.). **TALL CUP-FLOWER.** St. 1-3 ft. high, much branched, shrubby: lvs. scattered, linear: fls. about 1 in. broad, the limb saucer-shaped, white tinted with lilac or blue; throat yellow; handsome. Chile.—The fls. resemble *N. gracilis* in color, but are much larger. Valuable in the greenhouse or for the border. As a pot-plant it makes a fine bush and bears fls. almost continuously. It can be used as a bedding plant with excellent results if started under glass and transplanted. G. 33:109, 595. H.F. II. 10:9.—A garden form, var. *grandiflora*, Hort. (*N. grandiflora*, Hort.) has somewhat larger fls. than the type. Var. *albiflora*, Hort. Fls. white, appearing well with the foliage. Var. *atro-violacea*, Hort. Pretty plants, very compact, with dark violet fls. Reproduces well from seed.

S. W. FLETCHER.

A. C. HOTTES.†

NIGÉLLA (diminutive of *niger*, black; referring to the color of the seeds). *Ranunculaceæ*. **LOVE-IN-A-MIST. DEVIL-IN-A-BUSH. FENNEL-FLOWER.** Hardy annuals grown for their interesting flowers and seed-pods which are often surrounded by the much-divided involucre.

Stems erect: lvs. finely divided, alternate: fls. showy, white, blue or yellow; sepals 5, regular, petal-like, deciduous; petals 5, with hollow claws, notched or 2-lobed: carpels 3-10, fusing at the base into 1 cavity, cells opening at the top when mature; seeds many, black and hard. —About 12 species, including *Garidella*; mostly natives of the Medit. region. Following 3 are the only species now used in Amer.

Nigellas require little care. The seed should be sown in the open border in good soil any time after the land is fit to work in early spring, as the plants are entirely hardy. The seedlings should be thinned, if necessary, to a distance of about 8 inches. They seldom succeed well if transplanted. If the seeds are sown in early autumn, the plants may withstand a mild winter and be ready to



2482. *Nigella damascena*.

flower earlier the next summer. By planting at different seasons the plants may be continued in beauty nearly throughout the summer. The seeds of *N. sativa*, Linn., or black cummin, are sometimes used as seasoning in the Old World.

damsascēna, Linn. Fig. 2482. Height 1-2 ft.: lvs. bright green, very finely cut; fls. white or blue, large; involucre very dense and fine; styles erect in the fr., nearly as long as the caps.: fr. not divergent at top. Summer. S. Eu. B.M. 22. Gn. 37, p. 130; 63, p. 165. J.H. III. 51:61. Gn.M. 5:296. Var. *nāna*, Hort. A dwarf form with very large fls.

hispānica, Linn. Lvs. much divided, but less so than in the preceding; fls. deeper blue than the last, with deep red stamens; involucre absent; styles rather spreading; fr. divergent at top. July. Spain and N. Afr. B.M. 1265. Gn. 37:130. Var. *Fontanesiāna*, Hort. (*N. Fontanesiāna*, Hort.). Much like the type, but said to flower 2 weeks earlier. Var. *ālba*, Hort. Plant 18 in. tall; fls. white. Var. *atropurpūrea*, Hort. Fls. purple.

integrifolia, Regel. Lvs. less divided than either of the above species; fls. differing in being bell-shaped. Cent. Asia. B.M. 8245. G.C. III. 44:227.

K. C. DAVIS.

NIGGER-TOE: Nuts of *Bertholletia*.

NIGHT-BLOOMING CEREUS: *Cereus*, and other genera mentioned on p. 721.

NIGHTSHADE: *Solanum nigrum*. Deadly N.: *Atropa Bella-donna*. Enchanter's N.: *Circea*. Three-leaved N.: *Trillium*.

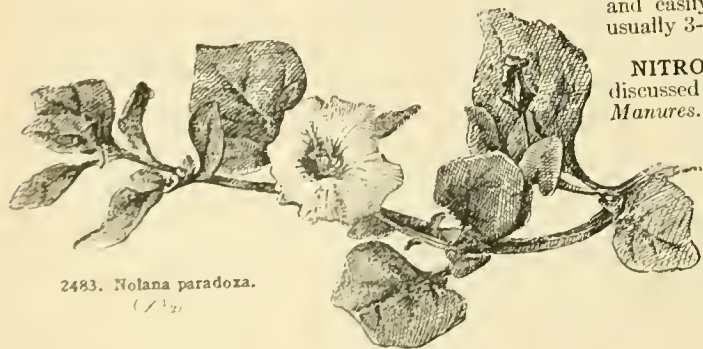
NINE-BARK: *Physocarpus*.

NINTOÛA (East Indian name). A name proposed in 1830 by Robert Sweet for certain species of *Lonicera* (see page 1910). *N. japonica*, Sweet = *Lonicera japonica*.

NIPA (native name in Molucca). *Palmææ*. One species of palm widespread along tidal rivers and estuaries, Ceylon to the Philippines and Australia, the great leaves much used in thatching, and the fruit edible.

Trunks or rootstocks prostrate, gregarious; lvs. pin-natisect, 10-30 ft. long, from the ends of the rootstocks; lfts. numerous, rigid, plicate, lanceolate, long-acuminate, 2-3 ft. long; fls. monocious, in an erect infl. springing from the rootstock; male fls. small, in catkin-like lateral branches of the spadix, stamens 3; female fls. larger, in terminal globose heads, the carpels 3; fr. large and spherical (as large as a man's head), comprised of many carpels or drupes 4-6 in. long. Toddy is extracted from the spadix, and from this product other materials (as sirup, sugar and vinegar) are made. Kernel hard and white, edible. *N. fruticans*, Wurm., is a most useful plant in the thatch-making in the Philippines (Figs. 1993, 1994, Vol. III), but it is probably not cult. to any extent. It has been intro. in S. Fla.

L. H. B.



2483. *Nolana paradoxa*.

(1/2)

NIPHÆA (Greek, *niphos*, snow; alluding to the white color of the fls., which is not usual in this family). *Gesneriææ*. Tropical American stemless or dwarf soft-villous herbs, with cordate, coarsely serrate lvs. and clusters of about a dozen fls. an inch or so across, borne singly on reddish stalks. For general cult. they are inferior to gloxinia and achimenes, but they are desirable for botanical collections. They have a creeping root, and no tubers; lvs. wrinkled, petiolate, opposite; corolla nearly wheel-shaped; disk absent; stamens 4 or 5; filaments short, straight; anthers erect, free, the cells facing inward, parallel, confluent at the apex.—Species 2, Guatemala and Cuba.

oblōnga, Lindl. Height 1 ft.: lvs. heart-shaped or perhaps somewhat oblong, more or less whorled, petioled and cordate at base, strongly serrate, hirsute and rugose; fls. drooping, winter; corolla about 1½ in. across, pure white, on slender reddish peduncles; lobes roundish, concave at first, then revolute. Guatemala. B.R. 28:5. H.U. 5, p. 301. L. H. B.

NIPHÓBOLUS. A name once in rather general use but now replaced by *Cyclophorus*, which see.

NITRÀRIA (Latin *nitrum*, natron; in reference to its habitat in nitrous soil). *Zygophyllææ*. NITERBUSH. Four low rigid shrubs distributed from S. Russia to Mongolia, W. China and Persia and through Asia Minor to Arabia and N. Afr., with alternate small fleshy, entire or dentate, stipulate lvs. and with small white or yellowish green fls. in terminal cymes followed by berry-like drupes; calyx 5-parted, fleshy; petals 5, concave; stamens 15; ovary superior, cone-oblong, attenuated into a very short style with 3 connivent stigmas, 2-6-celled; fr. an ovoid drupe with a sculptured 1-seeded stone dehiscant at the apex; cotyledons often 3. The following species is sometimes cult. in European botanic gardens and has been intro. recently by the Dept. of Agric. into this country and recommended as a sand-binder for cooler semi-arid regions; its fleshy fr. is edible. Prop. by seeds and by layers. It is of difficult cult. under ordinary conditions, as it is, like most desert plants, impatient of too much moisture and seedlings particularly are liable to damp off. It grows well in saline and alkaline soils; in ordinary soil an application of salt is recommended to grow it successfully.

Schöberii, Gmel. Spiny rigid shrub, to 6 ft., with whitish branches; lvs. obovate-oblong to linear-spatulate, obtuse or sometimes acutish, entire, thickish, silky while young, finally usually glabrous, ½-¾ in. long; fls. white, about ½ in. across, in stalked terminal cymes about 1 in. across; petals spatulate-oblong; stamens about as long as petals; fr. purple or blackish violet, rarely yellow, about ½ in. long. June; fr. in Sept. and Oct. From S. Russia to Mongolia, W. China and Persia. L.B.C. 14:1395.—By the Dept. of Agric. the plant was intro. from Turkestan as *N. retusa*, but *N. retusa*, Aschers., is a native of Syria, Arabia and N. Afr. and easily distinguished by its broadly obovate lvs. usually 3-toothed at the apex. ALFRED REHDER.

NITROGEN. The rôle of nitrogen in horticulture is discussed under *Fertility*, *Fertilizers*, *Legumes*, *Lime* and *Manures*.

NOLANA (from *nola*, a little bell; referring to the shape of the corolla). *Nolanææ*. Prostrate annual herbs with showy blue flowers opening only in sunshine, valued chiefly for covering poor or rocky places.

Stem often slightly angulate, usually spotted and streaked with purple above, glabrous or viscid-pubescent, much branched, the ends of the branches ascend-

ing several inches; lvs. solitary or in pairs, entire, usually fleshy, the lower long-petioled; the upper short-petioled, sessile or attenuated into a winged petiole; fls. borne singly in the axils of the lvs., mostly short-peduncled, commonly blue or purple, rarely white or rose; calyx 5-parted; corolla short funnel-shaped or bell-shaped, as in *Convolvulus*, entire, 5-angled or 5-10-lobed; ovaries 5 to many, 1-5-seeded, arranged in 1-2 series or clustered irregularly around the base of the style.—About 20 species, all native in Chile and Peru, mostly seacoast plants.

The characters by which several species of *Nolana* have been separated are not well defined. It is probable that *N. prostrata* and *N. paradoxa* should be considered as one species. The chief characters which have been used to distinguish them are the number of ovaries in each flower and the number of seeds in each ovary; but these characters vary in different plants of these and other species of *Nolana*.

Nolanas grow readily from seeds sown in the open in May. For early blooming and for seed-production they should be started under glass in March and transplanted in May. *N. paradoxa* is used with fine effect when planted in large patches in the border or on rocky hill-sides. All of the species do well in pots. They prefer a light soil and sunny situation. *N. paradoxa* is well suited for use in vases and baskets.

A. St. smooth or sparsely hairy.

B. Fls. large (1-2 in.), dark blue, not striped.

paradoxa, Lindl. (*N. atriplicifolia*, Hort.? *N. grandiflora*, Lehm.). Fig. 2483. Seven to 10 in. tall: root-lvs. very long-petioled, ovate; st.-lvs. ovate, mostly sessile or with winged petiole, fleshy; fls. large, 1-2 in.; sepals ovate-lanceolate; limb of corolla blue; throat white, inside of tube light yellow; ovaries commonly many, 1-seeded. Chile. B.R. 865. Not B.M. 2604, which is *N. tenella*.—This is the most common species in cult. Var. **alba**, Hort., has white fls. Var. **violacea**, Hort., has violet fls. F.S. 13:1294. H.F. II. 1:60.

BB. Fls. small ($\frac{3}{4}$ in.), light blue, striped with dark purple.

prostrata, Linn., not Hook. Resembles *N. paradoxa* but is distinguished by the st. being more reclining, the fl. is smaller and the throat of corolla marked with violet-purple veins; calyx pyramidal with triangular lobes; ovaries commonly few, 2-4-seeded. Perhaps this should be united with the preceding; it is native to Peru. B.M. 731.

AA. St. densely hairy.

B. St.-lvs. lanceolate, thick: plant hoary-pubescent.

lanceolata, Miers. St.-lvs. rather narrow, mostly in pairs, 2-6 in. long, the base obliquely clasping or slightly decurrent on the outer side; sts. hairy; fls. 1-2 in. broad, with a spreading 5-lobed limb, each lobe deeply notched; limb of corolla azure-blue, throat yellowish white, marked at the base with a line of purplish blue and spotted yellowish green. Chile. B.M. 5327. H.F. II. 5:55.

BB. St.-lvs. ovate, membranaceous: plant viscid-hairy.

tenella, Lindl. St. and whole plant viscid-hairy: st. slender: upper lvs. ovate, membranous, obtuse, with rounded base and winged petiole; peduncle long-hairy: fls. violet-blue, with a white throat; limb 5-lobed, each lobe tipped with a broad point. Chile. B.M. 2604 (erroneously as *N. paradoxa*, but poorly shown as no hairiness is indicated).—Not advertised in Amer.

S. W. FLETCHER.

A. C. HOTTES.†

NOLINA (C. P. Nolin, joint author of an essay on agriculture, Paris, 1755). *Liliaceae*, tribe *Nolineae*. Sub-acaulescent, or small trees, with dracena-like leaves, little cultivated except under glass, and some-

times in open grounds in southern California and comparable regions.

The liliaceous tribe *Nolineae*, in addition to *Dasylyrin*, contains 3 genera with unarmed lvs., so closely related that they have been united by excellent botanists under the genus *Nolina*.

As now limited, however, *Nolina* has panicked small polygamo-dioecious fls. and wingless 3-lobed 1-3-seeded often inflated fr.; *Calibanus* differs from it in the fr. being neither lobed nor inflated; *Beaucarnea*, like *Dasylyrin*, has 3-winged fr., neither lobed nor inflated, and its trunk differs from that of *Nolina* in being more swollen at base. S. U. S. to Cent. Amer. Monograph in Proc. Amer. Phil. Soc. 50 (1911), by Trelease; species 24. Other species than those enumerated below may be expected in the collections of amateurs. Treatment in cult. as for yuccas.

longifolia, Hemsl. (*Yucca longifolia*, Schult. Y. *Barrancasica*, Pasquale. *Dasylyrin longifolium*, Zucc. *Roulinia Karwinskiana*, Brongn. *Beaucarnea longifolia*, Baker). Rough-barked small tree 5-10 ft. high, with somewhat swollen base and few short branches crowded at top; lvs. thin, green, rough-edged, more or less frayed at tip, 1 in. x 3 ft. or more, gracefully pendent: infl. nearly sessile; fls. $\frac{1}{8}$ in. long; fr. $\frac{1}{4}$ in. long, $\frac{1}{2}$ in. wide, inflated; seed roundish, $\frac{1}{8}$ in. diam. S. Mex. Abhandl. Akad. Muenchen. Cl. 2. 3:1. R.B. 1865:20; 31, p. 230. Gn. 24:433. G.C. II. 7:493, 567. Bull. Soc. Ort. Tosc. 1890:6. G.W. 11, p. 14; 14, p. 199. G.Z. 3:20. Natur, 34:340. Gt. 29:117; 33:68. R.H. 1911, p. 206. Proc. Amer. Phil. Soc. 50:3, 8, 13, and p. 426.

The following species are given the nomenclature under *Beaucarnea*:

B. recurvata, Lem. (*B. tuberculata*, Roczl, *Nolina recurvata*, Hemsl. *N. tuberculata*, Hort. *Pincenectitia tuberculata*, Lem.). Becoming 30 ft. high, slender-branched above, swollen at base: lvs. green, thin, smooth-edged, recurving, $\frac{3}{4}$ in. x 3-6 ft.: infl. nearly sessile; fls. $\frac{1}{8}$ in. long; fr. unknown. S. E. Mex. I. H. 8, p. 58. G.C. 1870:1445; III. 46:4. D.G. Mag. 1871:288. Gt. 28:210. Gn. 19, p. 372. R.H. 1911, p. 207.—Tender in Cent. Fla.

B. guatemalensis, Rose. Fig. 2484. Slender, sometimes much-branched tree, 20 ft. high: lvs. green, thin, smooth-edged, recurving, 1 in. x 3 ft.: infl. short-stalked; fls. $\frac{1}{8}$ in. long; fr. $\frac{1}{2}$ x $\frac{5}{8}$ in. Guatemala. Contr. U. S. Nat. Herb. 10, p. 88.—Tender in Cent. Fla.

B. stricta, Lem. (*B. recurvata stricta*, Baker. *B. glauca*, Roczl. *B. Purpusi*, Rose. *Pincenectitia glauca*, Lem.). Becoming 30 ft. high, somewhat branched: lvs. pale, slightly rough-edged, straight, $\frac{1}{4}$ - $\frac{1}{2}$ in. x 2-3 ft.: infl. short-stalked; fls. $\frac{1}{8}$ in. long; fr. $\frac{1}{4}$ x $\frac{1}{2}$ in. S. Mex. D.G. Zeit. 28:223. Proc. Amer. Phil. Soc. 50:8, 14.

B. gracilis, Lem. (*B. oedipus*, Rose. *Nolina histris*, Hort.). Becoming 30 ft. high, greatly swollen at base, variously branched: lvs. very glaucous, rough-edged, straight, $\frac{1}{4}$ x 18-20 in.: infl. short-stalked; fls. $\frac{1}{8}$ in.



2484. *Beaucarnea guatemalensis*.

long: fr. $\frac{3}{4}$ in. long and broad. S. Mex. Contr. U. S. Nat. Herb. 10:23. Publ. Carnegie Inst. No. 99:19. Proc. Amer. Phil. Soc. 50:4, 11.

N. Hartwegiana, of gardens—but not the species properly so-called—a plant with round rough-barked st. about as large as a coconut and narrowly linear tufted lvs., is the type of a related genus, *Calibanus*, which differs in its rounded 3-celled fr. neither inflated, lobed nor winged, and is known as *Calibanus Hookerii*, Trel. (C. caespitosus, Rose. *Dasythron Hookerii* and *D. Hookeri*, Lem. D. caespitosum Scheidw. D. flexile, Koch. *Beaucarnea Hookeri*, Baker). E. Cent. Mex. B. M. 5099. Contr. U. S. Nat. Herb. 10:24, 25, and p. 90, fig. 4. Proc. Amer. Phil. Soc. 50:6, 8, 9, 11, 14.—The most beautiful of all this group is *N. longifolia*, when young, with its crown of drooping leaves 6 feet or more long, reaching to the ground. Few other true nolinias possess much beauty, but the caulescent species are odd and rather graceful, and Lower Californian forms like *N. Bigelovii*, Wats., *N. Beldingii*, Brandegee (G.C. III. 34:43) and *N. Parryi*, Wats., may succeed in the warmer parts of California.

WILLIAM TRELEASE.

NÓLTEA (after E. F. Nolte, professor of botany at Kiel; born 1791). *Rhamnaceæ*. SOAPBUSH. An evergreen glabrous shrub from S. Afr., with alternate short-petioled serrate lvs., small deciduous stipules and with small white polygamous fls. in terminal and axillary panicles: calyx campanulate, 5-lobed; petals 5, small, shorter than sepals, cucullate; the 5 stamens opposite the petals; ovary half-inferior, 3-celled; style rather short, with slightly 3-lobed stigma: fr. a caps., 3-valved, septiceid with 3 erect compressed seeds. The whole plant is saponaceous and the macerated foliage is used by the natives in washing. Sometimes used as a hedge plant in S. Afr. Cult. occasionally in S. Calif., though it has scarcely any particular ornamental quality. Prop. is by hardwood or greenwood cuttings and also by seeds. *N. africana*, Reichb. (*Ceanothus africanus*, Linn.). Upright shrub with virgate branches, to 12 ft.: lvs. oblong-lanceolate, serrate, obtuse, pale green below, 1–2 in. long; stipules small, roundish, thickish: fls. whitish, $\frac{1}{2}$ in. across in short axillary and terminal panicles crowded at the end of the branches into leafy panicles several inches long: caps. $\frac{1}{2}$ in. across. S. Afr. Sim, Forests and For. Fl. Cape of Good Hope, 37.

ALFRED REIDER.

NOPÀLEA (from the Mexican name of the cochineal cactus). *Cactaceæ*. A genus of 4 or 5 species, often placed with the opuntias, but differing from the latter in having erect petals, and stamens and style exsert beyond the perianth, as well as in some minor details. Natives of Trop. Amer. *N. coccinellifera*, Salm-Dyck (*N. inaperta*, Schott). An arborescent, flat-stemmed plant, with a somewhat cylindrical trunk 6–10 in. diam., widely grown in semi-tropical countries, but rarely found in the U. S., and then only in the largest collections of cacti. It is chiefly interesting in being one of the important food-plants of the cochineal insect. B.M. 2741, 2742 (as *Cactus cochinelifer*). *N. guatemalensis* and *N. lutea* are 2 recently described species from Guatemala which have been intro. into cult.

J. N. ROSE.

NORÔNHA (after Ferd. de Noronha, Spanish naturalist and traveler; died 1787). *Oleaceæ*. One tree or large bush, differing from *Olea* in having separate petals and in other characters. *N. emarginata*, Poir. (*Olea emarginata*, Lam.), is native in Madagascar and other islands, and is planted somewhat in Hawaii. Lvs. opposite, evergreen, short-stalked, coriaceous, cuneate-oblong and more or less retuse, entire: fls. yellowish, fragrant, in axillary clusters; calyx small, 4-toothed or -cut; petals 4, sometimes somewhat coherent at base: fr. an edible drupe, purple when ripe, globular, about 1 in. diam.; seed usually 1 (ovary 2-celled), in the sweet pulp.

NORTH AMERICAN STATES, Horticulture in. The descriptive articles on the horticultural resources of the North American continent are comprised in two parts: the symposium on British North America in

Volume I, and the present assembly. These together give a comprehensive view, and yet in some detail, of the present state of development in fruit-growing, vegetable-growing, flower-growing, and related activities in this vast area. Inasmuch as the statistical information is not comparable as between the British and the American parts of the continent, and as the markets and governmental control are different, as well as for other reasons, it has seemed best to treat the two parts separately, although the reader will want to consult them both to secure his view of the continent as a whole.

The article on Alaska naturally attaches itself to the present account. It is desirable, also, to present here an account of the horticultural possibilities of the Canal Zone (with its ten-mile strip across the Isthmus of Panama), although that region is not correctly a part of North America; but it belongs with the same governmental administration as the continental states of the Union, and the trade relations will naturally be close.

A third group of descriptive articles is found in Volume III, under the title "Island Dependencies." These insular areas are all tropical and therefore have a more or less common interest. The islands are Porto Rico, page 1689; Hawaii, page 1692; Guam, page 1696; Tutuila, page 1699; Philippines, page 1702.

In percentage of total value of all crops in the United States, the horticultural products reach not more than 13 per cent, even counting potatoes and sweet potatoes as within the definition. The census figures for the year 1909 give the percentage of value of vegetables (including potatoes, sweet potatoes and yams, and other vegetables) to be 7.6 per cent of the total value of all crops; of fruits and nuts to be 4 per cent; of flowers and plants to be .6 per cent; of nursery products to be .4 per cent. In average value to the acre in 1909, "flowers and plants" lead all crops, with \$1,911.02; small-fruits \$110.01 to the acre; potatoes, \$45.36; sweet potatoes and yams, \$55.25; "other vegetables," \$78.26. This may be compared with the acre-value of staple field crops, as cereals \$13.93; hay and forage, \$11.40; tobacco, \$80.55; cotton (including seed), \$25.74; sugar-beets, \$54.60; sugar-canes, \$55.40.

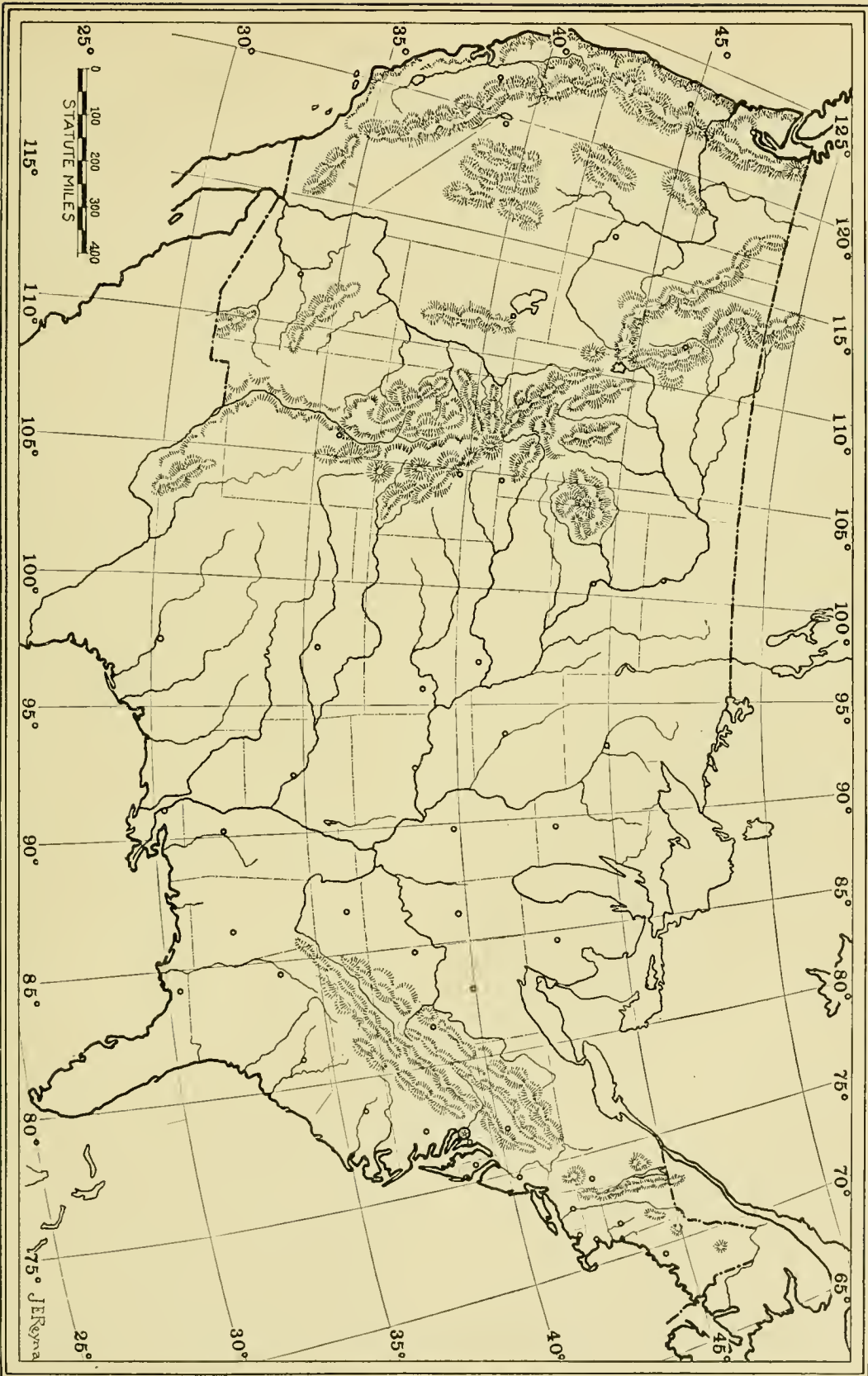
The territory of the continental United States comprises practically the whole range of climate. While none of it is within the tropics, the southern end of Florida is essentially tropical; the Gulf coast, southern Texas, southern California and the least elevated regions between are subtropical; and Alaska is partly within the arctic. There are long ranges of seacoast climates, and vast areas of midcontinental conditions. There are regions of unusually heavy rainfall, and others of very deficient precipitation and with desert conditions. There are widely different drainage systems, elevations from perpetual snow to depressions below sea-level, and the widest variations in soils and exposures. These wide ranges of conditions provide the physical basis for the most diverse horticultural pursuits. The mountain barriers and main drainage basins, as well as the seacoasts, are shown in Fig. 2485. This map may be joined to that of the British possessions, Fig. 652, on page 560.

The present symposium on the horticulture of the United States takes the form of an account by states; and these states are assembled in groups to represent geographical regions, as follows:

New England States.—Maine, page 2152; New Hampshire, page 2154; Vermont, page 2157; Massachusetts, page 2159; Rhode Island, page 2162; Connecticut, page 2164.

Middle Atlantic States.—New York, page 2167; New Jersey, page 2170; Pennsylvania, page 2173.

East North Central States.—Ohio, page 2176; Indiana, page 2179; Illinois, page 2182; Michigan, page 2184; Wisconsin, page 2187.



2485. Outline map of the United States, showing great drainage basins and some of the mountain masses.

West North Central States.—Minnesota, page 2190; Iowa, page 2193; Missouri, page 2196; North Dakota, page 2199; South Dakota, page 2202; Nebraska, page 2205; Kansas, page 2207.

South Atlantic States.—Delaware, page 2210; Maryland, page 2212; Virginia, page 2215; West Virginia, page 2218; North Carolina, page 2220; South Carolina, page 2223; Georgia, page 2226; Florida, page 2229.

East South Central States.—Kentucky, page 2232; Tennessee, page 2235; Alabama, page 2237; Mississippi, page 2240.

West South Central States.—Arkansas, page 2243; Louisiana, page 2246; Oklahoma, page 2249; Texas, page 2251.

Mountain States.—Montana, page 2255; Idaho, page 2257; Wyoming, page 2260; Colorado, page 2263; New Mexico, page 2266; Arizona, page 2269; Utah, page 2272; Nevada, page 2275.

Pacific States.—Washington, page 2278; Oregon, page 2281; California, page 2284.

Alaska, page 2287.

The statistics concluding the articles, compiled by Editor, are taken from the Thirteenth Census, 1910 (products of 1909). This is with the purpose not only to give the statistics of each state but to afford a basis of comparison between the states and to present the facts for the Union. As a basis of comparison, the main agricultural products are also given. The categories of fruits are those used in the Census classifications. It does not necessarily follow that "peaches and nectarines" means that there are nectarines growing in commercial quantities in the given state, or that loganberries are grown when the category is "raspberries and loganberries." In some cases in which these and other incidental fruits are known not to be grown, the names have been eliminated, but not always so. The statements are classificatory.

The Canal Zone (Fig. 2486).

When Balboa followed the narrow jungle trails of the Indians from one rambling settlement to another across the Isthmus, he probably noted, if he took any horticultural notes at all, that the economic flora was deplorably meager. The palm-thatched "bohios," as they called their one-room dwellings, were scattered along the high banks of the rivers, just above flood-mark; and the patches of root-crops and grains were massed close up under the watchful eye and ear of the planter,—to avoid depredations by the plentiful game animals, the deer, tapirs, agoutis, pacas, and their kind. This sort of make-believe horticulture, however, had been improving very slowly for thousands of years when the first Spaniard appeared on the scene.

If we hold, with O. F. Cook, that the first ideas of agriculture originated in the old Caribbean region, if we place the birth of the science back to the first purposeful covering of an otó tuber in a half-cleared plot somewhere about here some 50,000 years ago, then we must needs offer some explanation for the undeniable backwardness of tropical American horticulture at the beginning of the sixteenth century. We may rightly ignore all ethnological points in the case and assert that in this region a little more than anywhere else on the earth's surface did the food-plant growers have a pitifully laborious and precarious struggle with the primeval jungle. Indeed, it is doubtful whether even the present inhabitants of the Chagres Valley could eke out enough to live on from their little semi-cultivated patches if they were deprived of the machete and their few other "civilized inventions."

In point of fact, however, the indigenes of this region had a fairly large number of quasi-economics in use, not to say in cultivation. They probably depended upon the larger game animals to a great extent, with fish, snakes, and iguanas also *en ménú*; their main

root-crop was "yuca," or cassava (*Manihot dulcis* var. *Aipi*, *M. utilissima*), and to this day the "small farmer" of the interior of the Isthmus sets great store on "farina," the artificially dried, grated, peeled root. Otó, or Yautia (*Xanthosoma* spp.) was probably second in importance as a vegetable food and undoubtedly existed then in many forms. Of yams there were probably several species, all inferior to those now in evidence. The malanga, or taro (*Colocasia*), probably arrived with the Spaniards. The sweet potato may have been in evidence, but the present dialects of the Panamanian Indians (according to Pittier) contain no word for this root. And the "cacahuete," or peanut, was a prominent prehistoric crop from Mexico to Peru.

Among the fruits, the avocado, indigenous from Peru to Mexico (but not in the West Indies), demonstrates its nativeness by attaining a greater size here than elsewhere—2 feet in diameter, with a height of 65 feet or more, and fruits in proportion; the Mexican black-skinned and the Guatemalan hard-skinned varieties are unfortunately absent. The cashew (*Anacardium occidentale*) is and probably was common everywhere outside of the forests; the sister species, the espavé (*A. rhinocarpus*) is a conspicuous jungle giant. The guavas, though unable to compete with the forest species, are among the first to occupy cleared ground. The annonas were probably common; three forest species bear edible fruit. Two cainitos, or star-apples (*Chrysophyllum* spp.) are half or wholly wild. The calabash (*Crescentia Cujete*) was probably semi-cultivated for the sake of its fruit-rinds, used in lieu of crockery.

The pineapple probably made its first appearance to the public somewhere in this region. As to the bananas and plantains, it will probably never be known just how or when they were introduced (from Africa or, more probably, from the Orient); it seems certain, however, that there were a few varieties (out of the 300 or more) under cultivation when Balboa came. The anotto (*Bixa Orellana*) was doubtless used then, as now, for decorating the body and, mixed with palm-oil, to keep away mosquitos and the terrible "sand-flies" and ticks.

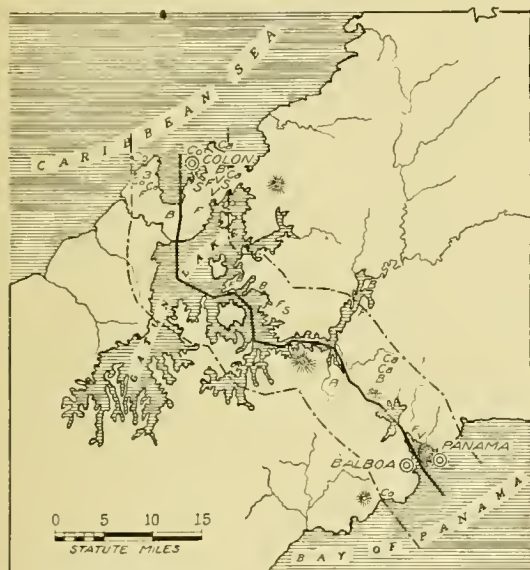
There were probably also peppers, ginger, papayas, maize, and beans in those plantations of 4,000 years ago; but unlike their distant neighbors, the Incas and Aztecs, the Isthmian planters neglected to set it down on stone records.

The first two centuries of civilization brought but little to this region in the way of new economic plants; but as soon as travel across the Isthmus became a real movement, and with pirates and brigands becoming unpopular, Panama horticulture began to improve. The Indian mango and the Polynesian bread-fruit arrived and soon assumed a permanent predominance over all other fruits, except the avocado and the musas. The citrus fruits, various vegetables, rice, sugar-cane, the akee (brought in with the slaves) and, of course, the ubiquitous tropical ornamentals (Aralia, Hibiscus, Acalypha, Codium, Jasminum, and others) came in due time. Many first-class economics, however, such as sapodillas, star-apples, sweetsops, tamarinds, mamee apples, and mamee apotaps, are still nearly or quite absent within the Zone boundaries. The French brought in a few good things. In 1906 to 1908, H. F. Schultz, as horticulturist, began the propagation of ornamentals and vegetables; through the auspices of David Fairchild and the writer, a good collection of economics was sent from the propagating-houses of the United States Department of Agriculture, at Washington, D. C., to the Zone, with partial success. About 1908-9, it was considered impracticable to raise fresh vegetables and fruits for the Canal Commissary, and until the native plantations began to be "bought in" by the Land Office, January 1, 1913 (by Presidential Order of December 5, 1912), Zone horticulture

was in a state of desuetude. Oranges, bananas, avocados, and the like, were sometimes gathered wherever it seemed expedient, without a definite policy of management, till October, 1914.

At present (1915), even, it is uncertain how far the Supply Department is warranted in going with the upkeep of the hundreds of small and large plantations expropriated from the Panamanian and West Indian settlers, and how many new plantations are actually required, first, in the interest of financial economy, and, second, as a safeguard measure: i.e., a meat, fruit and vegetable supply *in loco* in case of a sudden isolation of the Zone. (In fiscal year ended June 30, 1914, the Land Office settled 1,903 claims of squatters, aggregating \$147,452.50).

Corregidor Island, at the entrance to Manila Bay, according to report, has enough food-supplies in store in dry and refrigerated vaults to last the entire American population of the archipelago for more than one



2486. The Canal Zone. B, Bananas; Ca, Cacao; Co, Coconuts; F, Fruits; S, Sugar-cane; V, Vegetables.

year; a week's blockade of the Canal Zone would, under present conditions, cause considerable trouble, and three weeks with no commissary stock from overseas might be disastrous, since the contiguous Panama territory could supply only the cities of Colon and Panama, and then only a few things. Theoretically, nearly all the food required by the 30,000 or more employees and their families, who are almost entirely dependent upon the Supply Department for their daily food, may be produced in the Zone; practically, however, the daily quantum of 92 to 108 barrels of flour, about 285 bushels of potatoes, and the temperate fruits and some of the vegetables in like proportion, will always have to be imported.

At the beginning of 1915, there were practically no vegetables or fruits (except bananas and plantains) raised in the Zone, with the exception of a square mile or more of native fields near Colon which have not yet been expropriated, and the Hospital Farm at Corozal; the latter institution produces fresh eggs, milk, and a fair supply of radishes, okra, lettuce, papayas, and other things for Ancon Hospital.

At Las Guacas, 12 miles up the Chagres River from the lake,—i. e., some 6 miles beyond the east boundary of the Zone, but below the "100-foot level" (land along water-courses leading into the lake, up to 13 feet above

its mean water-level is also by treaty included in Zone territory)—there are two small banana and plantain "walks," which, when fully under cultivation, will turn out not only all of these fruits required by the local commissary stores, but will also supply, nearly at cost, all the steamers in port and in transit through the Canal, a very considerable demand.

At Juan Mina, also on the Chagres, just within the Zone limits, a citrous grove is now being established; with water transportation (forty minutes by launch to Gamboa railway station), good soil, and phenological suitability, as demonstrated by the few scores of very prolific native orange (seedling, of course) trees now in evidence there, it is thought that by 1918 or 1919 the absurd necessity of importing thousands of dollars' worth of pomelos, oranges, mandarins, limes, and other fruits from Florida, Costa Rica and Jamaica will be absolutely and permanently removed.

At Chocolate (formerly the Las Cascadas Plantation Co., Ltd., a British-capital concern), on the continental divide 5 miles from Culebra Cut, over six tons of dry cacao "beans" from only about 15,000 trees in "run-down" condition have been turned out in the first ten weeks of operation by the Supply Department. This estate boasts of having the oldest Castilla trees, planted as a crop, in the world. The unfortunate Castilla boom actually started, it is said, from these now 30-centimeter to 40-centimeter, moribund, worthless specimens, and an optimistic German scientist who happened to come by a dozen years or so since. The semi-abandoned cacao trees here broke the world's record, perhaps, for rapid maturing of the year end crop; six heavy pickings had to be made the first six weeks, instead of the two or three normal ones.

A grove of over 500 avocado seedlings, one of the largest in the world, has been set out at Frijoles; and mangoes, citrous fruits, pineapples, yams, sweet potatoes, and maize (for table ears) are going in, bananas and sugar-cane are also in evidence.

At Manawá and Puerto Escondido ("Condio," in local dialect), two native villages some 3 miles to the east of Colon, there are endless problems for the investigating horticulturist;—from major crops, like sugar-cane and cacao, through hundreds of acres of half-tilled patches of bananas, yams, and cassava, to fussy little questions of economy regarding the rejection or retention of small lots of coconuts, bread-fruits, avocados, limes, roselle, guavas, native squashes, ginger, and even cola.

At Venado, there are 20,000 non-bearing coconuts mostly in good condition. This plantation, if kept up under modern methods, will yield annually by 1925 sufficient oil to make some 300 tons of soap, enough to last the War Department a long time. At Sweet-water, there are several thousand coconuts in bearing, but in heavy bush and consequently in unprolific condition. In all there are twelve plantations now under some form of management by the Chief Quartermaster's Supply Department; the condition of these will be improved as rapidly as circumstances will permit; some may be extended, and a few more will probably be added.

As to the jungle: near the Canal there is no virgin forest left intact and, in fact, the better timbers have been culled out all along the Panama Railroad. The forest within sight of the steamers and trains is mostly second growth; this, however, is usually more dense than the old stand. Here is an opportunity for the Government to practise modern forestry and develop, say, 100 square miles of timber reserve.

As everywhere in Central America and the West Indies, the silver-lined leaves of the trumpet-wood (Cecropia) and the crumpled leaves of the also ugly companion *Didymopanax* are ever before the eye, just as some one of the four or five *Heliconias* is always in the way. Numerous *Bombacee* are to be found in or

around every forest area; their interesting bolls, if one may so term them, are as remarkable as their trunks; the trunk of one, *Bombax Barrigon*, is true to its vulgar Spanish specific name, in having a very "aldermanic rotundity" just above its base. The lofty but proportionately small crowns of the giant "Cuipo" (*Cavanillesia*) are a feature of the landscape near Pedro Miguel, which happens to be about the northernmost limit of this striking South American tree. There are, as everywhere in the tropics, many *Ficus* species, to puzzle future botanists. Mahogany and cedar are scarce, except near the Zone limits; however, the cutters' axes of a concessionaire can be heard from the orange plantation at Juan Mina. Some new *Leechthaceae* have recently been discovered by Pittier of the United States Department of Agriculture; some of the nuts rival the Brazil and Paradise nuts. Many excellent hardwoods are also in evidence.

The branches and trunks of the rough-barked trees usually support a varied flora of bromeliads, aroids, and orchids. On the Atlantic slope, where the rainfall averages around 125 inches a year, the orchids revel in a droughtless climate; the dry season—December to April, or longer—of the south or so-called west side of the Isthmus, the precipitation of which is just about one-half that of the Colon region, makes for a different flora. The most famous orchid here is the "Holy Ghost," or "Dove" (*Peristeria clata*); a corymb of flowers what they lack in size as compared with its bizarre sister species, *C. macrantha* of the Trinidad "high bush." The deep purple sobralias are striking; the butterfly orchids (*Oncidium* spp.) are everywhere, and range from buttonhole size (meaning the entire plant with its two bright yellow flowers) to the one with an 8-foot peduncle.

Several fine marantas and costus spp. and rank Zingiberaceae and Araceae encumber the ground wherever they can find plenty of shade and moisture. The carludovicias, that made Ecuador hats world-famous, abound in the denser jungles and are one of the worst sorts of weeds on the Manawá cacao plantations; in one ravine the petioles attain a length of 6 meters (20 feet)! Tagua (*Phytalephas* sp.) barely enters the Zone from the south. But the true palms are everywhere: *Acrocomia*, *Attalea*, *Bactris*, *Elais*, *Iriarteia*, *Hyospathe*, even the terrible desmoncus (worse than the calamus of the Philippines). Four species, at least, yield oil for the native table and two might prove of commercial importance, the corozo (*Acrocomia*) and the elais, for their kernels. Nuts of a small-fruited species of *Attalea*, the commonest large forest palm, may also through their great abundance be of value.

Most of the still-water reaches of the "3,000-mile coast-line" of Gatun Lake are more or less filled with luxuriant water lettuce and lesser evils in the way of aquatics; the Dredging Division is only now getting the two water hyacinths under control, after a strenuous fight with arsenical sprays by the hundred barrels. The shallow bays teem with micro-organisms; the many square miles of submerged forest furnish an excessive amount of decaying vegetable matter to feed the sub-aquatic life; billions of fish-fry are appearing now,—so thick in places that they may be scooped out with the hand. Pará grass and a papyrus-like rush are preempting the margin—an ideal habitat for the hippopotamus, which should be introduced as a margin-mower and aquatic-consumer to help out the Health Department in destroying mosquito breeding-grounds, and incidentally to furnish the Supply Department with the same kind of wholesome meat that South Africa once depended on.

In a word, then, here in the most important country of its size in the world, the Panama Canal is meeting an unprecedented problem: in 325 square miles of moderately suitable territory, more or less isolated,

how nearly self-supporting shall this area be made,—what sort of horticultural development should it have, and how much? The foreground is somewhat out of focus at present, but there are certainly some very interesting possibilities in the perspective.

O. W. BARRETT.

NEW ENGLAND STATES.

Maine.

Maine (Fig. 2487), the most easterly state in the Union, lies between latitude 43° 6' and 47° 27' north, and longitude 66° 56' and 71° 26' west. It has a very irregular coast-line, extending from Kittery on the south to Eastport on the extreme east, so broken by river and bay indentations as to measure about 2,500 miles in extent. About one-tenth of the area of Maine is water. There are about 2,200 lakes and ponds which act as reservoirs to hold in reserve the vast water-power of the state. It has three large river systems extending well into the interior, along whose courses are found the most fertile farms in the state. A central elevated plain extends across the state from west to east, at an elevation of 1,000 to 2,000 feet, near the center of which is Mount Katahdin, which has an altitude of 5,385 feet. A considerable part of the five most northern counties of the state are still covered with a heavy forest growth. In the northwestern section, this consists of pine, spruce, fir, hemlock and cedar; while farther south the conifers are replaced by birch, beech, oak, ash, maple, and the like. About three-fourths of the land area is classed as forest land. Maine ranks first among the states in its annual cut of spruce and fir, and third in white pine and birch. The annual cut of all timber is about 1,000,000,000 feet. The forest interests of the state are separated into two classes, viz., the Maine forest district of about 9,500,000 acres, and the forested area of towns and plantations of 4,500,000 acres.

A large part of the state is especially adapted to the growing of fruit of exceptionally high quality. It is true that the fruit-growing industry in Maine is in its infancy so far as modern methods are concerned. Local conditions are such that the most favorable opportunities exist for the development of this industry. Portland is one of the most convenient ports for the shipping of apples to foreign markets, and large quantities are sent each year. The natural fruit-belt of the state embraces the section south of latitude 44° 30', although some fine orchards are found in the center of the state extended to latitude 45° 10'. Latitude 45° north is regarded as the northern limit of profitable fruit-production, yet even in Aroostook County many orchards are yielding good returns, especially of such varieties as the Wealthy, Fameuse and Dudley Winter. The leading commercial fruit is the apple, the normal crop being about 1,000,000 barrels. The leading counties in the state in apple-production are Oxford, Cumberland, Androscoggin, Kennebec, Waldo and southern Franklin, Somerset, Piscataquis and Penobscot.

In York County, thrifty apple trees, over one hundred years old, are still bearing. These probably came from the famous Vaughan Nursery, in Hallowell, which was established about 1800. The Bowman Brothers, of Sidney, conducted an extensive nursery for a number of years, growing their stock from seeds taken from apple pomace at the cider-mill. The seedling trees were grafted to Baldwins, Rhode Island Greenings, Spy and other leading varieties. Remnants of the orchards set from this stock are still to be found in almost every section of the state. Many old seedling orchards, which yielded the once-famous "hard cider" for the Andrew Jackson political campaign, are still in existence, but these are rapidly passing with the coming of the movement for better fruit, and their places are being filled with the best commercial varie-

ties. In 1910, about 1,000,000 apple trees were set. This was probably the largest number ever planted in one year. There are four leading nurseries selling fruit stock, but only two that make a business of budding their own stock on to French seedlings. Many orchardists are top-working over their Ben Davis trees to such varieties as Baldwin, Spy, Rhode Island Greening, while Delicious and Opalescent are gaining favor.

The following varieties of apples originated in the state: Wealthy, from seed obtained in Bangor in 1860; Rolfe, in town of Guilford, about 1820; Starkey, in North Vassalboro; Dudley Winter, seedling of Oidenburg, originated at Castle Hill, Aroostook County; Winthrop Greening, Winthrop, about 1800; Quince, at Cornish, about 1850; Parlin, Norridgewock, about 1840; Stowe, Perham, Aroostook County, 1862, and Hayford Sweet, at Maysville, Aroostook County.

Fine peaches are grown in Oxford and Androscoggin counties, in the southwestern part of the state.

Fifty years ago large quantities of the finest Black Oxheart cherries were grown and shipped from Hallowell in Kennebec County, but the orchards have become neglected so that but few old trees remain.

Plums, pears, sour cherries and grapes are grown throughout the southern half of the state, as far north as latitude 45°.

Small-fruits of all kinds grow wild in lavish abundance, especially strawberries, raspberries, blackberries, blueberries and cranberries. For cultivated berries, strawberries easily take the lead and are grown very extensively for local markets and to ship to Boston. The small-fruit industry is a profitable one and is being extended each year. The conditions are ideal, as the fruit comes on the market after fruits from other states have disappeared, thus bringing good prices with a large market demand. In Washington County is a large tract of about 150,000 acres, called the "Blueberry Barrens," which brings in a big revenue to the owners. Several thousand bushels of the berries are sold as fresh fruit, but the large bulk goes to the canning industry, yielding an income of several hundred thousand dollars. Cranberries are found to some extent along the coast and also in inland sections.

Potatoes stand second in crop-production. The starch industry is an important one for Aroostook County, yielding in 1914 about 20,000,000 pounds. Aroostook County far exceeds any other county in the United States in potato-production. There is a larger output from this county than from all the other counties in the state combined. The leading varieties are the Green Mountain and Irish Cobbler, although a large number of other varieties are grown. Under trial tests over 700 bushels have been grown on an acre; six-acre lots have given an average of 460 bushels; ten-acre lots, 350 bushels. Farmers who adopt up-to-date methods average 300 bushels an acre. This can be done in any part of the state. The town of Presque Isle, the garden of Aroostook County, has potato farms valued at \$40,000. Contracts are made with growers in the southern states to supply Aroostook-grown potatoes for seed at \$1 a bushel for a term of five or ten years. The variety most grown for this purpose is the Irish Cobbler.

The leading vegetables grown, as market-garden produce, include snap beans, beets, cabbage, cucumbers, lettuce, peas, squash, sweet corn and tomatoes. Of the above crops, large quantities of beans, corn, peas and squash are used in the canning industry of the state. Although Cape Elizabeth is the leading market-garden center, there are many other sections largely engaged in this industry, notably the towns around Lewiston and Auburn in Androscoggin County; Saco and Biddeford in York County; Augusta and Waterville in Kennebec County; Bangor in Penobscot County, and Ellsworth and Mt. Desert, in Hancock County. Maine offers great inducement for market-gardening, cheap

lands are available, fine shipping facilities are offered, both by boat and train, while electric lines are being extended so as to reach and open up large areas not previously available.

The first regular Maine nursery was probably located in the town of Orrington, then a part of Buckstown, between 1804 and 1812, by Ephraim Goodale.

Among those who were influential in the development of Maine horticulture may be mentioned the following: Benjamin and Charles Vaughan, pioneer nurserymen; Ezekiel Holmes, the "Father of Aroostook;" Z. A. Gilbert; S. L. Goodale, nurseryman at Saco; D. H. Knowlton, authority on fruits; W. M. Munson, professor of horticulture; Phineas Whittier, the "apple king of Maine;" H. L. Deland, fruit-grower; James



Nutting, fruit-grower; Captain Elijah Low, plum-grower; G. B. Sawyer, one of the pioneers for better fruit in Maine; E. K. Whitney, expert at grafting; Solon Chase, "the Spy king;" Frederiek Hobbs, grape specialist.

Public-service agencies for horticulture

The first agricultural school in the United States was established in Gardiner, Maine, in 1821, called the "Gardiner Lyceum." This institution flourished until state aid was withdrawn in 1835.

The land-grant college was established in Orono in 1864 as "The State College of Agriculture and Mechanic Arts." The name was changed in 1897 to the "University of Maine." There are three members of the horticultural staff.

The Experiment Station was established in 1885 as a department of the University. The state owns two experimental farms, one situated in the town of Monmouth in Kennebec County, used particularly for work with apples, corn, and small grains. The other is situated in the town of Presque Isle, in Aroostook County, used especially for studies with potatoes, small grains and grasses. These are under the supervision of the Experiment Station. The staff of the Experiment

Station is a strong factor in the line of horticultural progress in the state, especially in plant-breeding, with such crops as potatoes, corn, oats, beans and fruits; plant pathology, rendering great aid in identifying plant diseases and giving directions for their control; entomology, where expert advice is given, by means of bulletins on insect pests of the farm, garden and orchard.

About fifteen of the secondary schools in the state are offering courses in horticulture.

The State Department of Agriculture at Augusta has charge of all the nursery inspection work of the state and also holds orchard demonstrations.

The Extension Department of the University was organized in 1907, and work is now being carried on in nine out of the sixteen counties. Farmers' institutes are also held by the Department of Agriculture.

The Maine State Pomological Society was organized in 1873 and has had a great influence on the horticulture of the state. There are nine local fruit-growers' associations which are doing good work for better fruit for Maine. The Maine Seed Improvement Association was organized in 1910. The Gardeners' Union of Lewiston and Auburn was organized in 1914 to promote horticultural interests. The Maine State Florists' Society was organized in March, 1915. The leading establishments in the state are located at Portland, Bar Harbor, Lewiston, Augusta, Bath, Bangor, Biddeford, Waterville, Freeport, Yarmouth, and Houlton.

Statistics (Thirteenth Census).

The approximate land area in 1909 was 19,132,800 acres. The land in farms was 6,296,859 acres or 32.9 per cent of the land area. The improved acreage in farms in 1909 was 2,360,657; the woodland in farms, 2,775,621; and other unimproved land in farms, 1,160,581. The total number of farms in 1910 was 60,016, the average acreage a farm being 104.9. [The total area of Maine is 33,040 square miles.]

The leading agricultural crops are hay and forage, forest products of the farms, and cereals. In 1909 hay and forage occupied 1,255,011 acres, or 53.2 per cent of the improved land area. The value of the products in 1909 was \$15,115,821, which was 38.4 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was \$5,573,763, as compared with \$2,652,252, their value in 1899. Cereals occupied 159,616 acres in 1909, the value of the production being \$3,100,902.

Horticultural products grown are tree-fruits and nuts, small-fruits, potatoes and other vegetables, and flower and nursery products. The value of the fruits and nuts in 1909 was \$2,215,116, as compared with \$841,811 in 1899, an increase of 163.1 per cent. Small-fruits decreased in acreage from 1,585 in 1899 to 1,260 in 1909, when the value of the products was \$233,124. The total acreage of vegetables, including potatoes, was 161,087, and their value \$12,377,717. This was a marked increase over the acreage in 1899 when it was 91,777. The acreage of flowers and plants and nursery products decreased from 178 in 1899 to 169 in 1909, when the value of the production was \$324,249.

The total quantity of orchard fruits produced in 1909 was 3,694,251 bushels, valued at \$2,207,748. This was a marked increase over 1899, when the value of orchard fruits was \$834,000. In 1909 apples contributed over 98 per cent of the total quantity; pears and plums and prunes most of the remainder. The number of bearing apple trees in 1910 was 3,476,616; those not of bearing age 1,045,123. The production in 1909 was 3,636,181 bushels of apples, valued at \$2,121,816. The number of pear trees of bearing age in 1910 was 46,683; those not of bearing age, 13,013. The production in 1909 was 38,964 bushels, valued at \$43,524. The plum and prune trees of bearing age in 1910 numbered 43,576; those not of bearing age, 22,491. The production in

1909 was 14,637 bushels, valued at \$31,954. The more important of the other orchard fruits were 2,403 bushels of cherries, valued at \$7,164; 2,014 bushels of peaches and nectarines, valued at \$3,205; and small quantities of apricots and quinces, valued at less than \$100.

The production of grapes is relatively unimportant in Maine. The total production in 1909 was 231,529 pounds, valued at \$6,954. The vines of bearing age in 1910 numbered 9,731; and those not of bearing age 1,944.

Few nuts are grown in Maine. The total production of nuts in 1909 was 12,922 pounds, valued at \$414. The value of the different nuts were as follows: butter-nuts, \$152; chestnuts, \$100; oil-nuts, \$60; and black walnuts, \$50.

Strawberries are by far the most important of the small-fruits grown in Maine, with raspberries and loganberries second in importance, closely followed by blackberries and dewberries. The acreage of strawberries increased from 512 in 1899 to 698 in 1909, when the production was 1,626,250 quarts, valued at \$168,847. The acreage of raspberries and loganberries decreased from 131 in 1899 to 127 in 1909, when the production was 154,121 quarts, valued at \$20,657. The acreage of blackberries and dewberries increased from 123 acres in 1899 to 145 in 1909, when the production was 153,816 quarts, valued at \$15,931. The production of cranberries in 1909 was 100,192 quarts, valued at \$7,957; that of currants, 76,031 quarts, valued at \$6,986; and that of gooseberries, 65,867 quarts, valued at \$5,881.

The potatoes are by far the most important of the vegetables. The acreage increased from 71,765 in 1899 to 135,799 in 1909, an increased acreage of 89.2 per cent. The production in 1909 was 28,556,837 bushels, valued at \$10,224,714, which was 26 per cent of the total value of all crops. Other vegetables increased in acreage from 20,012 in 1899 to 25,288 in 1909, when the value of the products was \$2,153,003. The more important of these vegetables were: 8,693 acres of sweet corn, valued at \$272,614; 353 acres of cabbage, valued at \$71,434; 472 acres of turnips, valued at \$42,585; 257 acres of green peas, valued at \$29,747; 201 acres of squash valued at \$22,460; 60 acres of tomatoes, valued at \$9,728; and 31 acres of cucumbers, valued at \$8,185. Other vegetables grown were green beans, beets, carrots, cauliflower, celery, lettuce, onions, radishes.

The acreage devoted to the growing of flowers and plants increased from 71 in 1899 to 112 in 1909. The total area under glass at this time was 706,917 square feet, of which 624,472 were covered by greenhouses, and 82,445 by sashes and frames. The total value of the flowers and plants produced in 1909 was \$301,005.

The acreage of nursery products, on the other hand, decreased from 107 in 1899 to 57 in 1909, a decrease of 46.7 per cent. The value of the nursery products in 1909 was \$23,244, as compared with \$46,207 in 1899.

E. F. HITCHINGS.

New Hampshire.

The soil of New Hampshire (Fig. 2488) is very variable. In fact there are practically no large continuous areas of any single type, and nearly every farm has several soil-types on it. In the main the soils are of granitic origin, being the result of glacial action together with a partial reworking of the glacial deposits by rivers and streams. Within narrow limits can be found all gradations of soil from sand to pure boulder clay, and they mostly carry a relatively high percentage of potash. In only a few sections of the state is any limestone soil found and the areas are rather limited. The soils of the valleys, coastal plains, and rounded hills are relatively fertile, but the highlands are rough, rocky, and mountainous and become more rugged as they extend northward until the White Mountains are reached. Roughly speaking, there is a high ridge,

mountainous in parts, extending from the Massachusetts line on the south to the White Mountains on the north and which lies a little west of the central part of the state. This ridge is the watershed between the Connecticut River on the west and the Merrimac River to the east. It is on the east and south sides of this ridge that many of the best orchards of the state are located and an exceptionally fine type of apple, especially Baldwin, is grown in these locations.

The state may be divided into three sections, horticulturally, as shown in the accompanying map. In the lower section are found by far the largest fruit interests and north of this line there is practically none of the so-called tender fruits, such as peaches. In the central



2483. New Hampshire, showing three agricultural divisions.

section, the apple and pear thrive and the opportunities for further development of the industry are excellent. The price of good apple land is reasonable and by means of the higher land a long-keeping, high-colored apple is produced. North of this central section there is little development of horticultural interests, although along the Connecticut River on the west and in northern Coos County to the north of the White Mountains, the hardier varieties of apples and small-fruits may be grown.

While the average rainfall for the state is 40 inches, the past few seasons have been much below this figure as recorded at Durham. In 1913, the rainfall for the year was 30 inches and in 1914, 31 inches.

The apple is the principal fruit grown in the state and may be said to be the leading horticultural product. The fruit thrives naturally throughout the southern half of the state as indicated by the large number of

seedling trees that spring up through the open fields and along the fences. In fact, many of the bearing trees (especially the older orchards) are these seedling trees top-grafted to desirable varieties. It is a common sight in New Hampshire to see the apple trees planted along the stone walls or as scattered trees about the farms, rather than planted in orchards. This, however, is not true of the younger plantings.

Like most other sections of the country, there is a greatly renewed interest in the fruit business and a large number of trees have been planted in the past ten years. Also, many non-residents are planting a part of the farms about their summer homes to apples. In 1913, New Hampshire was awarded the first prize on her state exhibit of apples in competition with the other New England states, and several times New Hampshire Baldwins have won the sweepstakes prize at the New England Fruit Show. The commercial outlook for fruit-growing in the state is bright and the fact that some of the best markets in the country are practically at its door has stimulated much of the planting. Many growers ship exclusively to foreign markets and it is a short haul to place the fruit on the steamship pier at either Boston or Portland.

Modern methods of orchard management are being used by the progressive growers, a number are packing their apples in boxes and realizing the highest prices for them; power spray outfits are in use in a number of sections and proper cultural methods are being practised by more growers each year. But, notwithstanding this renewed interest, in many sections it must be noted that the older orchards are dying at an alarming rate; especially is this true in the southeastern part of the state. Many are cutting out their trees, deeming them worthless and impossible of renovation. The primary causes of this general dying of the old trees are the insect pests which have been defoliating the trees year after year and the fact that they are standing in sod and receive no stimulation of any kind. The brown-tail and gypsy moths are the most serious insects in the state and both feed freely on the apple trees. It is not difficult to control them in the orchard, and continued education and demonstration should do much to check their ravages. It is a more difficult matter to introduce tillage methods for the apple, partly because the growers fear the lack of color which commonly results and also because the trees are often scattered or along fences as above mentioned. Several notable examples in the state of the good results of orchard cultivation are having their effect and many of the young orchards are being tilled.

The varieties most commonly grown are Baldwin, Rhode Island Greening, Northern Spy, Fameuse, Blue Pearmain, King, and McIntosh. The last-named variety has been more largely planted than any other in recent years. In some sections the Nodhead or Jewett's Red is grown largely, also the Roxbury Russet, Gravenstein, Hubbardston, Wealthy, Porter, Tolman Sweet, Bethel, Twenty Ounce, and many of the older varieties. Among the newer plantings are found considerable numbers of Delicious, Stayman and Winter Banana, but their adaptability to this section has not been established.

Plums are grown only in a limited way and they are mostly of the Japanese varieties. The domesticas have been abandoned largely because of the prevalence of black-knot. The Abundance, Burbank, Chabot, and Red June are the varieties commonly grown and they are able to withstand the winters to a sufficient degree to warrant their recommendation.

Peaches are successfully grown in several sections, notably about Portsmouth, Rochester, Derry, Wilton, Lyndeboro, and Milford. Instances are reported on good authority of obtaining nineteen successive crops, but this is quite unusual, possibly three out of five being nearer the average of the more favored regions. Practically all the peach orchards are cultivated, and crim-

son clover and buckwheat are favored cover-crops. Peach-leaf curl is found to a sufficient extent to necessitate spraying for its control, but peach "yellows" is not known to exist and brown-rot causes very little trouble. San José scale is found in a few places. The varieties commonly grown are Greensboro, Carman, Mountain Rose, Early Crawford, Champion, Belle of Georgia, Elberta and Late Crawford. The Elberta is more largely grown than any other.

Cherries are grown in a very limited way, there being no orchard of any size, although both the Early Richmond and Montmorency do well. Pears are receiving very little attention at present.

The grape is planted in a few sections but the season is rather short to insure their proper maturity. The Concord, Worden, Delaware, Brighton, and Niagara are mostly grown.

Of the cultivated small-fruits, the strawberry and red raspberry are grown more largely than the others. There is an increasing demand for small-fruits throughout the state as a result of the ever-increasing number of tourists and summer residents. This phase of horticultural development offers good returns, especially where it is possible to practise irrigation.

By far the most important small-fruit, however, is the blueberry. The season extends from early July until mid-September. There are no statistics as to the actual quantity of blueberries produced in the state, but it is safe to say that it is several times greater than the quantity of strawberries. The low-bush blueberry is the earliest in ripening its fruit, followed by the medium and high-bush types. Probably two-thirds of the total crop are from the low-bush plants. New Hampshire and Massachusetts blueberries bring the highest prices on the Boston market. This is due to the fact that the berries are largely of the high-quality low-bush type and are almost all hand-picked. The low-bush blueberries are found mostly on fine, sandy, peaty soils on high lands. In many instances, the sides and rounded tops of hills in the southern and central parts of the state are covered with practically a pure stand of low-bush blueberries; on other hills it occurs in open spaces between clumps of the wild ground juniper and native wild spires. The high and intermediate bush types are also found on high land but are more common on lower areas and on soils containing more moisture. A very limited start has been made in the cultivation of the high-bush blueberry. The low-bush type produces its finest fruit most abundantly on plants two and three years old, hence it is a common practice among owners of low-bush pastures to burn over a portion of the bushes each spring. Large shipping centers are the towns of South Lyndeboro, Greenfield, Alton and Milton, but almost all towns in the southern and central parts of the state ship at least in small quantities. They are usually marketed in the thirty-two-quart strawberry crates. The Boston dealers make a uniform charge of 2 cents a quart for selling, and the freight to Boston from most points in New Hampshire is 15 to 20 cents a crate. As a rule, the average price nets from 12 to 16 cents a quart at the first of the season and 8 to 10 cents a quart at the end of the season.

Market-gardening has been neglected in the past few years and as a result a large percentage of green stuff is shipped in from Boston, except in the height of the season. However, about Portsmouth and Dover and in the Merrimac Valley, considerable trucking is carried on. The Skinner system of irrigation is used in these sections and auto-trucks are used to some extent to market their product. Very little is done in growing vegetables under glass to supply the winter demands and most of the greenhouse vegetables are shipped in from Massachusetts.

Most of the greenhouses are found near the larger towns and cities and are mostly devoted to the growing of flowers. Roses are grown in a large way near Exeter

and Dover. The growers attribute their success to the type of soil in these sections. One grower at Exeter has 96,000 feet of glass and another near Dover has 153,000 feet, all of which is devoted exclusively to the growing of roses for the Boston trade. The varieties grown are White and Pink Killarney, Killarney Brilliant, Ward, Richmond, and Sunburst.

Some very good examples of landscape gardening are to be found about Dublin and Peterborough. Most of the estates are owned by summer residents. In many other sections of the state this art is being manifested and considerable money has been expended in beautifying the estates. About the numerous summer hotels through the mountains may be seen some good examples of the landscape art. The farm homes are kept up unusually well. Most of the houses are large and the buildings are kept well painted. Many artistic libraries and churches are to be found in the rural districts.

A few varieties of apples have originated in New Hampshire which have become distributed to some extent throughout eastern United States. Among the best known of these are the Granite Beauty, Mildens, Piper, and Red Russet.

Historically, New Hampshire can lay claim to an early recognition of the possibilities of growing fruit-trees and vines. In 1623, Ambrose Gibbons set the first vineyard, together with other fruits, near the mouth of the Piscataqua river near Portsmouth. There are many such old horticultural landmarks.

Many of the early settlers came from the southwestern counties of England. To them cider and perry seemed almost as necessary as food, and very soon after their arrival they began to set orchards of apples and pears. Their particular object was not the fruit itself, but the beverages made from it. The following item is taken from one of the many town histories that have been published in New Hampshire, and although it may be slightly exaggerated, it gives some idea of the apple industry one hundred years ago:

"About this time—1800 to 1810—the apple orchards in town which had been early set out, produced apples in abundance, which were made into cider. Every man had his orchard, and every tenth man his cider-mill. Every well-to-do farmer put into his cellar yearly from twenty to fifty barrels of cider which was all drunk on the premises. Col. John Bellows had an orchard of 30 acres, the largest in town. In 1805 there were 4,800 barrels of cider made and every drop drunk in town."

Public-service agencies for horticulture.

The New Hampshire College of Agriculture and the Mechanic Arts was created by an act of the Legislature in 1866 and was established at Hanover as a state institution, in connection with Dartmouth College. In 1893 the College was moved from Hanover to Durham. This action followed the death of Benjamin Thompson, of Durham, a farmer, who died January 30, 1890, and left his entire estate, with a few minor reservations, to the college. A department of horticulture was established in 1895, and at the present time there are five members of the horticultural staff, which includes one instructor who devotes his entire time to extension work.

The Experiment Station is located at Durham in connection with the Agricultural College. It was established in 1887. There are sixteen members of the staff at the present time, representing nine departments. The horticultural department has leased a Baldwin apple orchard near Durham for experimental purposes. There have been issued twenty-five bulletins on horticultural subjects.

The extension work in New Hampshire may be said to have had its real beginning in September, 1911. Among the activities of the extension service, the horticultural department has been carrying on some special demonstration work in several orchards.

The New Hampshire Horticultural Society was organized in 1893. It is in a prosperous condition.

There is a law in the state providing for the inspection of nursery stock, also a State Moth Department which has under its control the state and federal activities in the control of the gypsy and brown-tail moths.

Statistics (Thirtieth Census).

The approximate land area of New Hampshire in 1910 was 5,779,840 acres. The land in farms was 3,249,458 acres, or 56.2 per cent of the land area. Of this land in farms, 929,185 acres were improved; 1,502,389 were in woodland; and 817,884 acres other unimproved land in farms. The number of all the farms in 1910 was 27,053, and the average acreage to the farm 120.1. [The total area of the state is 9,341 square miles.]

The leading agricultural crops of the state are hay and forage, and cereals. The acreage occupied by hay and forage decreased from 615,042 in 1899 to 529,817 in 1909, when the value of the production was \$7,846,143. Cereals decreased in acreage for the same period from 42,335 in 1899 to 32,928 in 1909, when their value was \$879,631. The value of forest products of the farms in 1909 was \$3,610,178, as compared with \$2,296,265 in 1899.

Horticultural crops grown in New Hampshire are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$734,387 as compared with \$728,520 in 1899. Small-fruits decreased in acreage from 730 in 1899 to 618 in 1909, when the production was 998,244 quarts, valued at \$107,365. In 1909 the total acreage of potatoes and other vegetables was 26,225 and their value \$2,276,177. Excluding potatoes, the acreage of other vegetables increased from 7,357 in 1899 to 8,855 in 1909 when the production was valued at \$1,071,551. The acreage devoted to flowers and plants and nursery products increased from 72 in 1899 to 117 in 1909, when the production was valued at \$248,041.

The production of all the orchard fruits in 1909 was 1,165,044 bushels, a decrease of 42.3 per cent from the production in 1899. In 1909 apples constituted more than 95 per cent of the total production, and peaches and nectarines and pears most of the remainder. The production of apples in 1909 was 1,108,424 bushels, valued at \$637,990. The number of apple trees of bearing age in 1910 was 1,240,885; those not of bearing age 207,289. The production of peaches and nectarines in 1909 was 23,218 bushels, valued at \$37,884. The peach and nectarine trees of bearing age in 1910 numbered 57,571; those not of bearing age 35,213. The production of pears in 1909 was 24,224 bushels, valued at \$25,206. The number of pear trees of bearing age was 36,816 and those not of bearing age 9,397. There were also produced in 1909: 7,542 bushels of plums and prunes, valued at \$14,039; 1,403 bushels of cherries, valued at \$4,133; quinces, to the value of \$456; and apricots, to the value of \$68.

The production of grapes and nuts in New Hampshire in 1909 was relatively unimportant. Grapes produced 375,164 pounds, as compared with 487,500 pounds in 1899. Their value in 1909 was \$10,926. The production of nuts in 1909 amounted to 254,521 pounds, valued at \$3,684. The nuts produced were 217,431 pounds of butternuts, valued at \$2,597; 13,330 pounds of black walnuts, valued at \$375; 8,446 pounds of hickory-nuts, valued at \$303; and 5,479 pounds of chestnuts, valued at \$242.

Of the small-fruits grown in New Hampshire, strawberries are the most important, with raspberries and loganberries ranking next. Strawberries increased in acreage from 307 in 1899 to 310 in 1909 when the production was 638,057 quarts, valued at \$68,552. Raspberries and loganberries increased in acreage from 80 in 1899 to 85 in 1909, when the production was 86,558

quarts, valued at \$11,821. Other berries produced in 1909 were 75,913 quarts of blackberries and dewberries, valued at \$7,793; 43,319 quarts of currants, valued at \$4,587; 30,304 quarts of cranberries, valued at \$2,686; and 5,841 quarts of gooseberries, valued at \$683.

The acreage devoted to potatoes in New Hampshire decreased from 19,422 in 1899 to 17,370 in 1909, when the production was 2,360,241 bushels, valued at \$1,204,626. Excluding potatoes, the more important of the other vegetables produced in 1909 were 589 acres of sweet corn, valued at \$28,835; 163 acres of cabbage, valued at \$21,184; 51 acres of tomatoes, valued at \$7,143; 68 acres of turnips, valued at \$6,832; and 29 acres of onions, valued at \$6,560. Vegetables of minor importance in 1909 were asparagus, green beans, beets, carrots, celery, cucumbers, green peas, squashes.

The raising of flowers and plant and nursery products is of little importance in New Hampshire. The acreage devoted to flowers and plants in 1909 was 93, as compared with 38 in 1899. The total area under glass in 1909 was 752,313 square feet, of which 719,848 were covered by greenhouses and 32,465 by sashes and frames. The value of flowers and plants produced in 1909 was \$236,144. The acreage devoted to nursery products decreased from 34 in 1899 to 24 in 1909, when the production was valued at \$11,897, as compared with \$7,012 in 1899.

J. H. GOURLEY.

Vermont.

Vermont (Fig. 2489) is not and never will be a great horticultural state. Aside from the apple, strawberry, onion, and potato, the cultivable land is largely devoted to farm crops and dairying. The Champlain and Connecticut valleys are well adapted to fruit and vegetable crops. Apple orcharding throughout the state, but especially in sections noted above, offers the best opportunity. Much of the hill-town land should revert to forests.

In general, the soils of Vermont are well adapted to the culture of orchard-fruits. The limestone and granitic soils, especially on the west side, seem particularly fitted to the development of a thrifty long-lived tree. With but few exceptions, the soil is deep and retentive of moisture. The necessity for irrigation is the exception rather than the rule. Drainage is seldom necessary for orchard plantations; although for small-fruits and vegetables, tiling is desirable. Cover-crops are not used to the extent which their merit justifies.

The home markets for fruit and vegetables are unusually good. Strawberries rarely sell for less than 12½ cents a quart, and the average price for good fruit is probably nearer 15 cents. Blackberries usually bring 10 cents, and raspberries 10 to 20 cents. Cherries can generally be bought, the price being \$3 to \$4 a bushel. Good vegetables sell equally well. With such favorable markets, supported by numerous small manufacturing villages and a horde of summer boarders, horticultural industries certainly ought to thrive.

The horticultural regions of Vermont are, roughly, three. The first and most important is the Champlain Valley district, including several large islands in Lake Champlain. This region reaches toward Montreal on the north; and the general character of its horticulture is much like that in the St. Lawrence Valley between Montreal and Lake Ontario. Winter apples are the most important crop in this section. The second region lies in the southwestern part of the state and belongs to the upper Hudson Valley. Apples will grow readily when properly attended, but they are seldom eared for. Greater success is secured with small-fruits, the growing of which is greatly encouraged by the large annual immigration of summer residents. The third district comprises the valley of the Connecticut. It is the least developed of the three, horticulturally. The reason for this is not plain. Soil and climate are admi-

rably adapted to all sorts of fruits. Even peaches are successfully grown in orchards. The few men who grow plums, cherries, strawberries, and so on, are proving every year that the Connecticut Valley in Vermont is naturally as much a fruit region as any other.

The apple crop in Vermont is fast assuming commercial proportions. There are many large orchards in every county, and in almost every town. Commercial orcharding is best developed on the western border, including the Champlain Valley, and extending southward to Bennington, where there is a 300-acre orchard. The market varieties are Rhode Island Greening, Northern Spy, Baldwin, Wealthy, Fameuse and

that is shipped out of the state. Each of the three separate islands of the county are entirely surrounded by the waters of Lake Champlain and enjoy thereby greater immunity from frost than other sections of the state. The first large orchard in the county (also in the state) was set in 1819, and embraced 20 acres, all of cider-apple stock which sold for 10 cents a bushel to French people from Canada. In 1848 and 1861 other large orchards were set, and in 1870 the work of planting trees was widespread. In 1912, the Eastern Fruit and Nut Orchard Company started its 215-acre orchard, which is interplanted with plums, cherries, and fillers. It is doubtful whether any region can produce apples of finer appearance, better quality or greater durability, than can be produced in Grand Isle, Vermont.

Plums are grown just enough to prove that they will succeed admirably. Lombard, Green Gage, Bradshaw, the Damsons and other old-fashioned sorts still retain preference of conservative Vermonters, although other growers are planting chiefly of the Japanese varieties, especially Burbank and Abundance. In the northern and mountain towns, only the americana and nigra types are hardy; but even these are seldom grown.

Pears have no commercial importance in the state. The localized orchards of a generation ago were swept out by the pear-blight, and the plantings replaced with apples. With proper care, the hardy varieties succeed.

Among cherries, Morello, Montmorency and Richmond are favorites. Raspberries are mostly red, the black berries being seldom grown. Cuthbert is the leading variety, though Schaffer and Columbian are gaining rapidly. Blackberries are carefully grown usually. Fine blueberries are picked from the fields in considerable quantities. Early varieties of grapes can be ripened for home use, Concord, Worden, Moore Early, Green Mountain and Delaware being leading varieties.

Vermont is remarkably free from many noxious insects and serious diseases. The area infected with San José scale is confined to a few towns in a single county in southeastern Vermont. The gypsy moth does not as yet occur in the state; and the brown-tail moth area is restricted to the southern and eastern borders, and further extension is being combated with vigor. Apple blotch and bitter-rot are not known to occur in the state. Crown-gall and hairy-root diseases are rare.

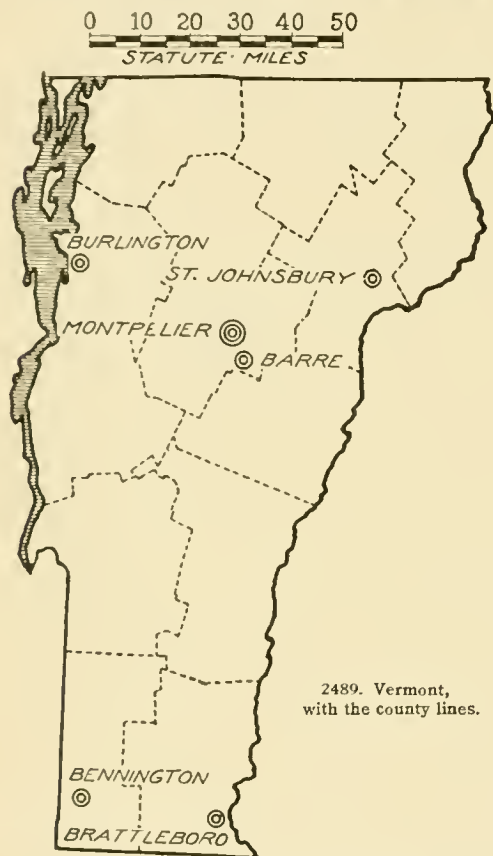
Truck-gardening is practised in the neighborhood of all the principal cities; but it cannot be said to be a well-managed business. Those crops which grow in special perfection are beans, potatoes, peas and tomatoes, salsify and parsnip. Those which cannot be grown, or which are, as a rule, unsuccessful, are melons, okra, sweet potatoes, and lima beans. Special crops which are sometimes grown in quantities for export are seed peas, white beans and onions.

On account of the long cold winter and the short and cloudy days of that season, the greenhouse industries have developed slowly. Notwithstanding this fact, many towns make demands for greenhouse products and every city in the state supports two or more greenhouses, devoted mostly to carnations, roses, chrysanthemums, lilies, and pot-plants.

There are three commercial nurseries in Vermont. One at Charlotte specializes in hardy ornamental shrubbery, and those at Waterville and Beebe Plains are apple nurseries.

Some very good examples of landscape gardening may be found about Bennington, Manchester, Shelburne, Burlington, and Woodstock, many of which are summer homes of city people. Island and shore camps in the Champlain district are especially attractive.

Several Vermonters of an earlier generation who were influential in either developing new horticultural varieties or testing the adaptability of varieties from other countries, were: C. E. Goodrich, originator of the Garnet Chile potato, and introducer of the Amazon, Calico, Cuzeo, Central City, Rust Coat, and Pink



McIntosh. The old family orchards of innumerable inferior varieties are rapidly disappearing through old age and neglect. The greatest plantings of apple trees in a generation have been made since 1910. Vermont has had experience with the Russian apples, T. H. Hoskins, of Newport, on the northern boundary of the state, having been one of the most famous experimenters. Nevertheless, the Russian varieties have made small impression on the pomology of the state.

In all probability there are more extensive orchards in Vermont than in any other New England state. In 1870, the notable orchard of C. T. Holmes, of Charlotte, which embraces 105 acres, was set mostly to Rhode Island Greenings. In 1880, the famous Richford orchard in Highgate was set to a single variety,—Fameuse. Within a few years other orchards of similar proportions have been set. The most famous apple section of Vermont is in Grand Isle County, known to commercial men as the "Island Apple County." Grand Isle, which is the smallest county in the state, is the most important commercial apple section by reason of the small population and the relatively large proportion of the crop

Eye potatoes; Albert Breese, of Hubbardston, originator of the Early Rose potato; Cyrus Pringle, of Charlotte, a scientific plant-breeder and eminent botanist (see Volume III, page 1591); E. C. Brownell, originator of the Brownell Best, Beauty, Eureka, Superior, and Winner varieties of potato; Albert Rand, originator of the Rand Peachblow potato, thought by some to be the Perfect or Improved Peachblow; and T. H. Hoskins, Newport, in the northern part of the state.

Public-service agencies for horticulture.

The Agricultural College of Vermont is located in Burlington, and is an integral part of the University of Vermont. In 1862 the Legislature chartered the Vermont Agricultural College, but it was not until 1865 that it was incorporated with the University. Instruction in horticulture was not begun until 1874, and in 1890 the department was established for instruction to students in the four-year course. The teaching is carried by one professor.

The Experiment Station is a part of the University and is coördinate with the College of Agriculture. There are three members of the horticultural staff. Twelve bulletins have been published on horticultural subjects, aside from annual report articles.

There are two state schools of agriculture, located at Randolph and Lyndon Center, where courses in horticulture are given. As a separate subject, horticulture is not taught in the public schools, although it receives some attention in a general agricultural course which is now offered in six public schools.

There is no state department of horticulture, although the State Commissioner of Agriculture devotes some time to horticultural welfare work. The inspector of nurseries is appointed by the Commissioner of Agriculture. An expert entomologist, similarly appointed has charge of the suppression of especially noxious insects.

Extension work in horticulture is carried on in connection with the College of Agriculture. The Vermont State Horticultural Society, organized in 1896, is also furthering the horticultural interests in the state.

Statistics (Thirteenth Census).

The approximate land area of Vermont in 1910 was 5,839,360 acres. The land in farms was 79.9 per cent of this area or 4,663,577 acres. Of this land in farms, the improved land numbered 1,633,965 acres; the woodland, 1,566,698 acres; and other unimproved land in farms, 1,462,914 acres. The total number of farms in Vermont in 1910 was 32,709, and the average acreage to the farm, 142.6. [The total area is 9,564 square miles.]

The leading agricultural crops of the state are hay and forage and cereals. The acreage devoted to the production of hay and forage increased from 1,006,375 in 1899 to 1,030,618 in 1909, when the production was valued at \$16,335,530, which was 54.9 per cent of the total value of all crops. Cereals decreased in acreage from 160,127 in 1899 to 134,611 in 1909, when the production was valued at \$2,651,877. Forest products of the farms in 1909 were valued at \$3,638,537, as compared with \$2,108,518 in 1899.

Horticultural crops grown in Vermont are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$818,851, as compared with \$459,508, in 1899. Small-fruits increased in acreage from 418 in 1899 to 469 in 1909, when the production was 826,122 quarts, valued at \$92,030. The total acreage of potatoes and other vegetables grown in 1909 was 35,408, and their value, \$2,615,299. Excluding potatoes, the acreage of the other vegetables increased from 5,131 in 1899 to 8,548 in 1909, when the value of the production was \$872,183. Flowers and plants and nursery products decreased in acreage from 112 in 1899 to 60 in 1909, when the production was valued at \$89,740.

The total quantity of orchard-fruits produced in 1909 was 1,492,499 bushels, valued at \$801,365. Apples contributed nearly all this quantity, and pears most of the remainder. Apple trees of bearing age in 1910 numbered 1,183,529; those not of bearing age, 219,833. The production in 1909 was 1,459,689 bushels, valued at \$752,337. Pear trees of bearing age in 1910 numbered 26,315; those not of bearing age, 7,726. The production of pears in 1909 was 20,763 bushels, valued at \$23,788. Other orchard-fruits produced in 1909 were: 7,205 bushels of plums and prunes, valued at \$12,927; 2,506 bushels of cherries, valued at \$7,651; 2,221 bushels of peaches and nectarines, valued at \$4,399; and minor quantities of quinces and apricots.

The grape-production in 1909 was 203,011 pounds, valued at \$6,328. The grape-vines of bearing age in 1910 numbered 9,318; those not of bearing age, 1,845.

The production of nuts in 1909 was 891,825 pounds, valued at \$11,158. Butternuts were the most important of the nuts in 1909, the production being 845,899 pounds, valued at \$9,872. Other nuts produced were: 32,910 pounds of black walnuts, valued at \$725; 9,516 pounds of hickory-nuts, valued at \$410; and 3,350 pounds of chestnuts, valued at \$149.

Of the small-fruits grown in Vermont, strawberries are the most important, with raspberries and loganberries ranking next. The acreage devoted to the production of strawberries increased from 232 in 1899 to 276 in 1909, when the production was 615,820 quarts, valued at \$68,690. Raspberries and loganberries decreased in acreage from 92 in 1899 to 80 in 1909, when the production was 85,065 quarts, valued at \$10,596. Blackberries and dewberries decreased in acreage from 48 in 1899 to 47 in 1909, when the production was 56,252 quarts, valued at \$6,032. Currants increased in acreage from 30 in 1899 to 58 in 1909, when the production was 58,533 quarts, valued at \$5,684. In addition, there were produced in 1909, 7,424 quarts of gooseberries, valued at \$728, and 1,120 quarts of cranberries, valued at \$110.

Potatoes, the most important of the vegetables grown in Vermont, decreased in acreage from 28,353 in 1899 to 26,859 in 1909, when the production was 4,145,630 bushels, valued at \$1,743,049. The more important of the other vegetables produced in 1909 were: 1,110 acres of sweet corn, valued at \$35,650; 98 acres of cabbage, valued at \$16,263; 29 acres of onions, valued at \$6,780; 64 acres of turnips, valued at \$6,543; 18 acres of tomatoes, valued at \$4,236; 31 acres of cantaloupes and muskmelons, valued at \$4,082; 39 acres of green peas, at \$2,615; and 24 acres of beans, valued at \$1,587.

The acreage devoted to the production of flowers and plants, decreased from 38 in 1899 to 23 in 1909. The area under glass in 1909 was 178,199 square feet, of which 162,339 were covered by greenhouses, and 15,860 by sashes and frames. The value of the flowers and plants produced in 1909 was \$78,726, as compared with \$58,575 in 1899.

Nursery products decreased in acreage from 74 in 1899 to 37 in 1909. The value of the nursery products in 1909 was \$11,014, while their value in 1899 was \$49,625.

M. B. CUMMINGS.

Massachusetts.

The horticultural interests of Massachusetts (Fig. 2490) are fully equal to those of agriculture proper, when one considers the production of fruits, vegetables, flowers, and the labor and expense applied to the growth of ornamental trees, shrubs and plants and their use in decorating the homes, among which there are probably more comfortable, well-kept and beautiful homes than can be found in any similar area in the world. The people of this state probably consume more of the luxuries of life than any other people on the same area, and

among the so-called luxuries may be classed fruits, fancy vegetables, and flowers.

The soil of Massachusetts is generally considered unproductive and poorly adapted to horticultural pursuits, and this is true in so far as it refers to large areas of exceptionally fertile land, of which that in the Connecticut Valley is the only section of more than a few acres in extent. Everywhere about the state, however, there are small areas of land suited to the growth of almost every crop succeeding in similar latitudes. By business enterprise, persistent effort, and skill, profitable horticultural crops can be grown. The local products largely supply the markets in their season. Apples are also exported.

There are no large areas devoted to the growth of either orchard- or small-fruits in Massachusetts, but small areas of nearly all these fruits are very profitably grown in most sections of the state. The amount of fruit produced within the limits of the state is not nearly up to the home consumption, except cranberries, and possibly the apple in some seasons. Even in seasons of an unusual crop in the state, large quantities of apples from other states are shipped into our markets, because in many cases they are of superior size and beauty.

Apples of especially fine quality are grown on the granite soils of the middle and northern sections of the state, extending from Newburyport to Athol on the north, and from Northbridge to Needham on the south, and a small area in the Connecticut Valley.

Pears are grown in small areas within a short radius of most of the cities and large towns, eastern Massachusetts being particularly adapted to this fruit. Pears are also shipped into our markets from the southern states and California, and as the market for this fruit is limited, prices often rule very low.

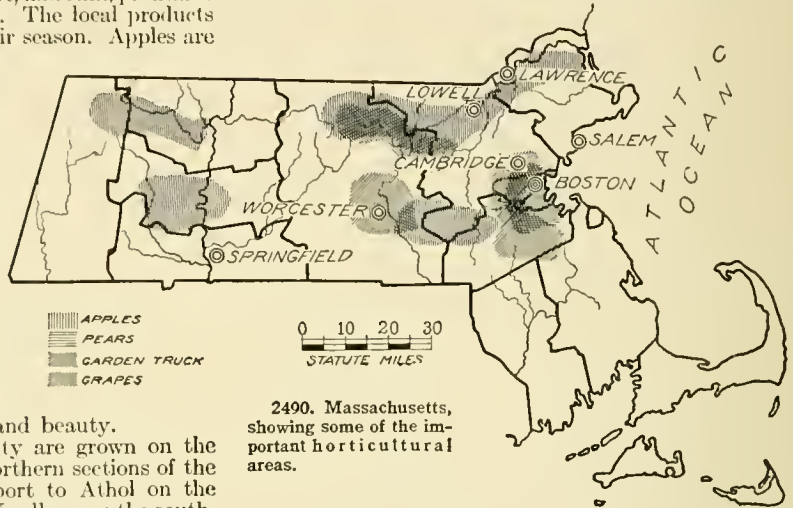
Peaches of the finest quality are profitably grown more or less over the entire state on elevated land with a northern, northwestern, or northeastern exposure. On low land and that with a southern exposure the fruit-buds are winter-killed three years out of five. However, even under these conditions, when the trees are planted on rather light high land and well cared for, one crop in three years is often more profitable than most other fruit or vegetable crops. The fruit on trees well grown is large, of the finest color and quality, and the fresh, ripe condition in which the grower can put it into the local markets makes it quickly salable at the highest prices. The peach-belt may be included in that of the apple.

Plums are not grown to a great extent, the larger markets being supplied largely by New York and California. Few orchards remain productive longer than ten or twelve years, on account of the black-knot, leaf-blight and brown-rot. Within the past ten or fifteen years both European and Japanese plums have been largely planted, but they succeed only for a short time, except with the best care. They are planted in small numbers in poultry-yards and gardens.

The cherry, owing to the attack of the black aphid, the plum-cureulio and brown-rot, is very little grown as an orchard-fruit. A few vigorous and productive trees may be seen here and there by the roadside, about old homesteads or on the lawn, where they live longer and attain greater size than when grown under a high state of cultivation in the garden or orchard, because of the fact that when grown too rapidly the trunks crack on the south side and the trees soon die. Our markets are largely supplied with cherries from California, New York, and other states.

Grapes have been more or less planted from Fitchburg on the north to Concord and Lexington on the south, but succeed only on elevated land with a southern exposure. Only the earliest varieties can be grown unless the fruiting canes are girdled.

Small-fruits are more grown and more nearly supply local markets than do the large fruits, but are grown only on small areas. The supply of very early fruit comes from the southern states of the country, but home-grown fruit is so much superior in quality that



it sells at reasonable prices, notwithstanding prices may have been very much reduced by an over-supply of the southern product. Of the small-fruits, the strawberry is the most widely grown. There are no large areas especially devoted to strawberries, but most homes have strawberry-beds of good size. Currants are grown to a considerable extent, almost every garden containing more or less currant bushes for home supply, while many large plantations may be found near every large town or city. The conditions of success are a rather moist, rich soil, with the bushes trained into a very compact form and pruned so that the fruit will be borne on wood that is not over three or four years old. Gooseberries are little grown, although the demand is rather on the increase. The more hardy kinds can be as easily grown as the currant, while the European sorts and their hybrids, many of them, require much care and skill. Like the currant, the blackberry is largely grown for home use, and also for market. It succeeds upon a great variety of soils, can be grown cheaply and sells at good prices. Few plantations will be profitable on the same land more than from five to seven years unless the soil is strong and rich. It is the practice of most growers to plant a new lot every six or seven years. The red raspberry is the most popular of the bush-fruits, and when successfully grown is the most profitable. For success it requires a deep sandy loam, retentive of moisture, but plantations must be renewed after six or eight years' growth on one piece of land. The blackcap raspberry has found less and less favor each year, and can only be sold at very low prices in the city markets.

The business of market-gardening has made rapid strides in the state in the past ten years, and the demand for choice vegetables continues more or less the year round. Even in the matter of competition with vegetables from the South during the winter, the local growers have reached a good degree of success. The truck-gardens are mostly located near large cities where products can be shipped by freight or express. In almost every part of the state may be found forcing-

houses for the growth of lettuce, tomatoes, cucumbers, rhubarb, asparagus, and the like, and notwithstanding the cost of such structures and the fuel to keep up the necessary heat, the increase in the number of forcing-houses in the state within the past few years is a certain indication that the business is profitable.

It is perhaps in the growth of cut-flowers and house and decorative plants that Massachusetts excels in horticulture. As a rule, the largest establishments of this kind are located near the large cities, though in some cases they may be found in some of the more rural towns. The horticulturists of Massachusetts understand their advantages in having the best markets in the world at their doors, and a great variety of the soils suitable for the growth of many of the varied crops. By persistent effort and superior skill they could supply these markets largely, and thus retain within the state much of the wealth that now goes outside to pay for the produce that could be raised at home.

In commercial horticulture, Massachusetts is not the equal of some other states, although its market-gardening and floricultural interests are large, but its influence on the horticulture of the country is more important than acres and tonnage. The best horticulture is that which develops under difficulties, because it develops the man. The love of the country and attachment to its own soil are strong in Massachusetts. Individuality has full course. It is a land of home-loving people. It has developed the amateur horticulturist to perfection,—the person who grows the plant and dresses the soil for the very love of it. There are many large collections of choice plants, and great numbers of artistic, compact and tidy garden-homes. There is keen appreciation of the merit of well-grown things. The influence of the Massachusetts Horticultural Society has been incalculable. It is our oldest and strongest geographical organization. Since 1829 it has had its stated discussions, held its periodical shows, collected its library and records. It is a center of education and culture. The establishment of Mt. Auburn Cemetery, Cambridge, in 1831 was the beginning of the movement in this country for cemeteries in the open as distinguished from the churchyard.

A list of persons influential in developing the horticulture of Massachusetts must necessarily be incomplete, as so much amateur and professional interest in horticulture has developed in this state. The following persons, however, may be mentioned: Marshall P. Wilder (see Volume III, page 1603); Robert Manning (page 1587); C. M. Hovey (page 1580); W. C. Strong (page 1598); O. B. Hadwin. W. W. Rawson (page 1593); Jabez Fisher, and many others. "The History of the Massachusetts Horticultural Society," published in 1880, should be consulted for many other personalities.

Public-service agencies for horticulture.

The land-grant college of Massachusetts was established at Amherst in 1865, and opened for work in 1867. There are at present seven members of the horticultural staff.

The Experiment Station is also located at Amherst, being established in 1882. Its horticultural staff numbers fifteen members.

Extension work is also carried on throughout the state. Bureaus are being established in each county, which are giving invaluable aid to the horticulturist.

The State Board of Agriculture supports a series of lectures upon agricultural and horticultural subjects. Several counties have established agricultural and horticultural schools, and a few of the high-schools are introducing these courses.

Special inspectors are appointed for nursery inspection and the control of insect pests and diseases. There are also special bee inspectors.

Statistics (Thirteenth Census).

The approximate land area of Massachusetts in 1910 was 5,144,960 acres. The land in farms numbered 2,875,941 acres, or 55.9 per cent of the land area. The improved land in farms numbered 1,164,501 acres; the woodland in farms 1,064,553; and other unimproved land in farms 646,887. The number of all the farms in 1910 was 36,917; the average acreage to a farm being 77.9. [The total area is 8,266 square miles.]

The leading agricultural crops are cereals, hay and forage, and tobacco. There was a slight increase in the acreage occupied by cereals from 53,385 in 1899 to 55,267 in 1909, when the value of the products from cereals was \$1,617,131, or 5.1 per cent of the total value of all crops. The acreage devoted to hay and forage decreased from 610,023 in 1899 to 519,503 in 1909, when the value of the production was \$11,280,989, or 35.3 per cent of the total value of all crops. The acreage of tobacco increased from 3,826 acres in 1899 to 5,521 acres in 1909, when the value of the production was \$1,218,060. The value of forest products produced on the farms in 1909 was \$2,668,410, as compared with \$1,944,714, their value in 1899.

Horticultural crops are the fruits and nuts; small-fruits; vegetables, including potatoes; and flowers and plants and nursery products. In 1909 the value of the fruits and nuts produced was \$2,108,799, as compared with \$1,218,659, the value in 1899. The acreage of small-fruits increased from 8,346 in 1899 to 9,552 in 1909, when the value of the small-fruits was \$1,676,790, or 5.2 per cent of the total value of all crops. In 1909 the total acreage of potatoes and other vegetables was 61,686, and their value \$8,184,213. The acreage of vegetables, excluding the potato, was 37,220 and their value \$6,189,857, both acreage and value being decidedly greater than in 1899. The raising of flowers and plants and nursery products is of relative importance. The acreage increased from 1,478 in 1899 to 2,750 in 1909, when the value of the products was \$3,061,342, which was 9.6 per cent of the total value of all crops.

The total quantity of orchard-fruits produced in 1909 was 2,763,679 bushels, valued at \$2,074,270. Apples contributed more than nine-tenths of this quantity; peaches and pears most of the remainder. The number of apple trees of bearing age in 1910 was 1,367,379; those not of bearing age, 355,868. The production in 1909 was 2,550,259 bushels, valued at \$1,780,290. The number of peach and nectarine trees of bearing age in 1910 was 154,592; those not of bearing age, 162,114. The production in 1909 was 91,756 bushels, valued at \$138,716. The number of pear trees of bearing age in 1910 was 113,365; those not of bearing age, 38,378. The production in 1909 was 96,071 bushels, valued at \$110,069. In addition, 17,814 bushels of plums and prunes were produced in 1909, valued at \$28,253; 4,761 bushels of cherries, valued at \$10,848; 2,863 bushels of quinces, valued at \$5,754; and minor quantities of apricots and mulberries.

Grape-growing has little significance in Massachusetts. In 1910 the grape-vines of bearing age numbered 58,277; those not of bearing age, 14,261. The production in 1909 was 1,132,838 pounds, valued at \$30,858.

Nuts are of less importance than grapes. The total production in 1909 was 134,920 pounds, valued at \$3,671. The leading nuts were: 40,064 pounds of black walnuts, valued at \$1,219; 60,151 pounds of butternuts, valued at \$984; and 23,834 pounds of hickory-nuts, valued at \$904.

Cranberries are by far the most important of the small-fruits grown in Massachusetts, with strawberries second in importance. The acreage of cranberries increased from 5,128 in 1899 to 6,577 in 1909, when the production was 22,714,496 quarts, valued at \$1,062,205. The acreage of strawberries for the same period decreased from 2,027 in 1899 to 2,015 in 1909, when the production was 5,518,867 quarts, valued at \$495,438.

The more important of the other small-fruits produced in 1909 were 376,136 quarts of raspberries and loganberries, valued at \$55,757; 307,987 quarts of blackberries and dewberries, valued at \$31,454; 213,810 quarts of currants, valued at \$19,904; and 57,827 quarts of gooseberries, valued at \$5,007.

The potato is by far the most important of the vegetables. The acreage decreased from 27,521 in 1899 to 24,459 in 1909 when 2,946,178 bushels were produced, valued at \$1,993,923. Among the leading vegetables grown in 1909, excluding potatoes, were: 2,493 acres of onions, valued at \$624,630; 2,442 acres of cabbage, valued at \$126,586; 1,187 acres of celery, valued at \$368,854; 4,942 acres of sweet corn, valued at \$355,953; 1,228 acres of tomatoes, valued at \$268,380; 372 acres of cucumbers, valued at \$179,084; 776 acres of asparagus, valued at \$116,622; 1,068 acres of turnips, valued at \$95,751; and 555 acres of squash, valued at \$91,388. Vegetables of minor importance in 1909 were green beans, beets, carrots, cauliflower, eggplant, parsnips, green peas, green peppers, radishes, rhubarb and spinach.

The acreage devoted to the production of flowers and plants increased from 584 in 1899 to 1,203 in 1909, an increase of 106 per cent. The total area under glass in 1909 was 7,382,009 square feet, of which 6,817,585 were covered by greenhouses, and 564,424 by sashes and frames. The value of the flowers and plants produced in 1909 was \$2,455,467, as compared with \$1,639,760 in 1899.

The acreage devoted to nursery products increased from 894 in 1899 to 1,547 in 1909, an increase of 73 per cent. In 1909 the value of nursery products was \$605,875, as compared with \$260,069 in 1899.

S. T. MAYNARD.

Rhode Island.

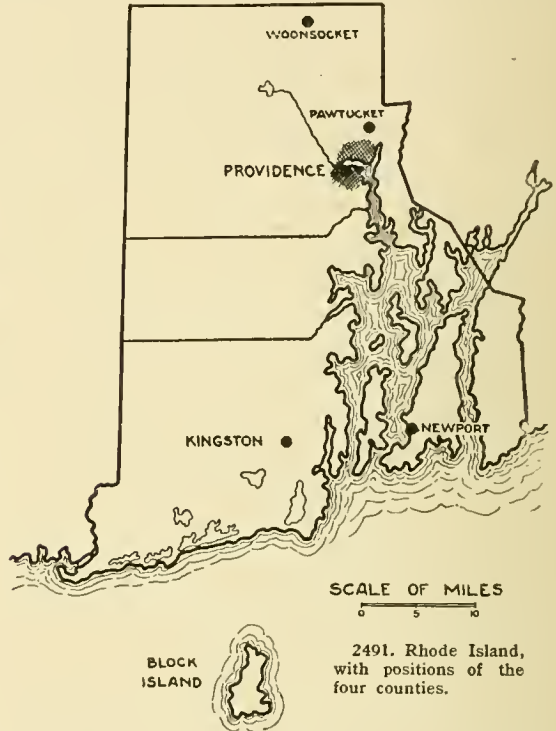
The general topography of Rhode Island (Fig. 2491), is of a hilly nature, tending to become more broken after leaving the ocean shores of the southern part of the state and of Narragansett Bay, which extends as a triangular body of water from Long Island Sound to Providence. This bay with its numerous islands and fine shores has resulted in the development of a number of summer resorts which furnish an excellent market for locally grown horticultural products.

Geologically there are within the state two distinct physiographic provinces, the eastern or Narragansett basin area, which comprises the eastern third of the state, and the western or more mountainous area of hill remnants from one of the ancient east Appalachian mountain ranges. Included within the Narragansett area are the islands of the bay and an area which follows the western shore of the bay, extending at no point more than 3 miles inland, and from the head of the bay, it extends northward across the boundary of the state. Topographically, this region consists of smoothly rounded hills, not exceeding 250 feet in height, and of gently rolling glacial plains. The inland or rougher area consists of rough and stony hills. Considerable areas of fresh-water swamps are found within this province; there are also many small lakes. The state lies wholly within the glaciated area.

The average annual rainfall for the state is approximately 48 inches, being somewhat greater than this in the southern section of the state which is locally influenced by proximity to tidewater.

With a population of 508.5 to the square mile, there is furnished a market for horticultural produce which is far in excess of the ability of the state to supply. This condition, together with the close proximity of both the Boston and New York markets, affords market conditions most favorable for an intensive horticultural development in the future. With 96.7 per cent of this population classed as urban, the demand created

for perishable food-products has resulted in the development of vegetable-gardening as one of the most specialized horticultural industries of the state. The regions where this specialization has been most largely developed have the cities of Providence and Newport as their centers. In addition to the cities, the many villages devoted to manufactures and the summer resorts furnish markets that are supplied by producers who cannot be classified as market-gardeners, yet who derive a very substantial proportion of their cash income from the growing of vegetables and fruits. It is this class of growers which exert a very marked influence upon the agricultural prosperity of the state.



The sandy soil types of the state, when abundantly supplied with water, are well suited to the growing of high-quality vegetable products. Although all of the different vegetables are grown in abundance, the following may be mentioned as of special importance: lettuce of the hard-headed Boston market type, the loose-leaf varieties being practically unknown in the wholesale markets; tomatoes are produced in large quantities, the larger growers relying almost entirely upon the Stone or some improved strain thereof; green corn is a profitable crop, large quantities of which are used for roasting with clam dinners served daily at many of the shore resorts throughout the season. The standard variety for this trade is the Potter's Excelsior corn. Vegetable-growing will be the most important commercially of any horticultural enterprise for many years to come.

Building of improved roads by the state, together with the development of the automobile as a means of getting farm produce to market, is beginning to exert a marked influence upon the areas devoted to horticultural products. This is shown most conclusively in the areas which are being planted to the tree-fruits in the northwestern section of the state. The rough land in this section which has heretofore been inaccessible to market, on account of lack of transportation facilities, is capable of producing fruit of high color

and quality. Varieties of fall apples, such as the Graevenstein, find a ready market at remunerative prices, while for the main crop, the standard varieties are Rhode Island Greening, Baldwin, McIntosh and Spy. Of the stone-fruits, the peach is the most largely grown, orchards being found in all sections of the state. Those growers whose orchards are situated on the higher slopes along the shores of Narragansett Bay and upon the island of Rhode Island suffer much less injury from winter-killing of the buds and frost-injury in the spring than do those growers whose orchards are located farther inland; the latter, however, have less trouble with the various fungous diseases. The area devoted to the peach is being extended each season, particularly in the counties of Bristol and Newport. Cherries and plums are grown only in very limited quantities, the local markets being supplied almost entirely by shipments from other states. The plum is being grown profitably in those sections removed from the seashore. Of the cherries, the sour varieties are the most profitable, on account of the great difficulty in growing the sweet varieties in many sections, and are now being planted more than formerly.

Pears are not produced in large quantities for market, although the total number of trees of this fruit is large, as it is more commonly grown in the small house-lot than any other fruit. To such an extent is it produced upon these small holdings that the market demand for the summer and early fall varieties is very limited while for the later varieties, such as Bosc, Lawrence and Sheldon, there is an unsupplied demand in the city markets which would probably justify the commercial planting of this fruit.

In the production of varieties of fruit the state has played little part, its most important contributions being the Rhode Island Greening apple and the Buf-fum pear.

Of the small-fruits, strawberries and cranberries are of the most importance commercially. The acreage devoted to the small-fruits has shown a very material decrease in recent years. The largest production of strawberries is in Providence and Newport counties, the crop being grown almost entirely in wide matted rows. Cranberries are most largely produced in Providence and Washington counties. When proper attention is given to the bogs, they are the most profitable of the farm areas; the bulk of the crop is produced upon natural bogs which are overflowed during the winter months by adjacent streams. The prices received are such as to justify the paying of more attention to this crop, as many of the natural bogs are so located as to be easily flooded at a comparatively small expenditure.

Currants, raspberries and gooseberries are mostly grown for home consumption with the result that the markets are never properly supplied. The prices received for these fruits are such as to make them profitable when grown under commercial conditions. Blackberries are not profitable as a rule, owing to the extensive areas of the wild fruit throughout the state.

Of the horticultural changes during the past decade, the most marked has been the decrease in the production of vegetables under glass and the increase in floricultural products. Many large ranges of glass which were formerly wholly or in part devoted to the production of lettuce, tomatoes and cucumbers, are now being used for the growing of roses, carnations and lily-of-the-valley. The area under glass devoted to the production of flowers has more than doubled in the past decade. Where formerly the trade was confined almost entirely to cut-flowers, now much attention is being given to the production of potted plants for home-decoration. Vegetable-forcing at present is being conducted, in most cases, as an adjunct to the general market-gardening business, forcing vegetables to maturity only at those seasons of the year when the

houses and hotbeds are not needed for growing of stock for transplanting to the fields.

Nursery stock is receiving much more attention than formerly, the area devoted to the growing of nursery stock having been increased two and one-half times during the past ten years. The business is confined almost entirely to the growing of ornamental trees and shrubs. On the island of Rhode Island are several nurseries which make a speciality of those plants best suited for planting near the seashore. Stock from these nurseries, while not making so large a growth of tops as that produced farther inland, has a root-system which is unexcelled.

Throughout the state are many fine estates, among which may be mentioned the many summer homes in the vicinity of Newport, where the famous cliff walk is lined for several miles with beautiful lawns and grounds, some of which are noted for the fine collections of ornamental trees and shrubs. While one is constantly reminded that Rhode Island is primarily a manufacturing state, yet the large number of fine suburban homes, the small grounds of which are planted with most excellent taste and upon which are found growing collections of fruits which furnish a succession throughout the entire season, shows a high appreciation of nature upon the part of many of her inhabitants.

The metropolitan park system of the state centered at Providence, which has for its object the development of pleasure-grounds and the conservation of historical sites, is receiving liberal support and the commission in charge of the work is rendering a most valuable service to the state in the development of love for the beautiful in nature.

Throughout the state many farms which have been neglected by their former owners are passing into the hands of foreigners, especially Italians and Portuguese, who are clearing much of the rough land of rocks and brush and using the land for the growing of truck and fruit. The immediate development of the state will be away from the general farm crops and toward the growing of the more perishable crops. There are within the state most excellent opportunities for the development of horticultural enterprises, either along the fruit or vegetable lines, as the urban population is increasing much more rapidly than the population engaged in the production of foodstuffs.

Among those individuals who have exerted a marked influence upon the horticultural development of the state, the following may be mentioned: Solomon Drowne, M.D. (1753-1834), who was professor of botany in Brown University, and in 1824 published "The Farmer's Guide, a Comprehensive Work on Husbandry and Gardening;" the Moore family for many years were very active in the development of fruit-growing and ornamental horticulture in the state, especially Silas Moore (1818-1879), nurseryman; Robert E. Moore (1820-1902), orchardist; Robert I. Moore, (1835-1899), landscape gardener; James Nesbit, landscape gardener; and James A. Budlong (1823-1895), market-gardener.

Public-service agencies for horticulture.

The leading agency in the dissemination of horticultural information throughout the state is the Rhode Island State College located at Kingston. This institution was established by act of the state legislature, March 23, 1888, as the Rhode Island State Agricultural School, the first class entering in September, 1890. On May 19, 1892, the institution was incorporated by the state legislature and its name changed to the Rhode Island College of Agriculture and Mechanic Arts. Again, after the passage of the Adams Act by Congress, the name was changed to the Rhode Island State College, this change occurring May 4, 1909. There are two teaching members of the horticultural staff.

The Rhode Island Experiment Station, located at Kingston, is a department of the State College, its work being conducted by a staff of seventeen. At present there is no horticulturist upon the staff. There have been published nineteen horticultural bulletins, besides numerous horticultural articles in the annual reports.

Horticulture is not taught in any of the public schools of the state as a text-book subject. School-gardens were established by the Extension Department of the State College in 1905, which work has developed very rapidly since 1908, the coöperation of the State Board of Agriculture and school authorities of the various cities and towns having been secured at that time. In addition to the school-garden work, the Extension Service conducts orchard demonstrations in spraying and pruning.

The State Board of Agriculture is by law empowered to employ an entomologist who has charge of all nursery inspection work in connection with insect pests and diseases.

The most important societies of horticultural interest in the state are the Rhode Island Horticultural Society of Providence, Newport Horticultural Society, Florists' and Gardeners' Club of Providence and the Providence Market-Gardeners' Association. The latter society has for its object the betterment of conditions under which the growers for the Providence market dispose of their produce.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 682,880 acres. The land in farms was 64.9 per cent of the land area, or 443,308 acres. Of this land in farms, the improved land numbered 178,344 acres; the woodland, 185,909 acres; and other unimproved land in farms 79,055 acres. The number of all the farms in 1910 was 5,292, and the average acreage was 83.8. [The total area of Rhode Island is 1,248 square miles.]

The leading agricultural crops of the state are hay and forage and cereals. The acreage devoted to hay and forage decreased from 69,776 in 1899 to 61,327 in 1909, when the production was valued at \$1,309,717, which was 33.3 per cent of the total value of all crops. Cereals increased in acreage from 10,552 in 1899 to 12,112 in 1909, when the production was valued at \$376,097. The value of the forest products of the farms was \$312,022 in 1909, as compared with \$195,472 in 1899.

Horticultural crops produced in Rhode Island are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of fruits and nuts produced in 1909 was \$207,844, as compared with \$160,411 in 1899. Small-fruits decreased in acreage from 581 in 1899 to 281 in 1909 when the production was 437,560 quarts, valued at \$43,033. The total acreage of potatoes and other vegetables in 1909 was 9,924, and their value \$1,045,093. Excluding potatoes, the other vegetables increased from 5,165 in 1899 to 5,275 in 1909, when the production was valued at \$636,656. Flowers and plants and nursery products increased in acreage from 263 in 1899 to 502 in 1909, when the production was valued at \$634,087.

The production of orchard fruits in 1909 was 245,822 bushels, valued at \$197,639. Apples produced most of this quantity, and peaches and nectarines and pears most of the remainder. The number of apple trees of bearing age in 1910 was 152,009; those not of bearing age 51,560, and the production in 1909 was 212,908 bushels, valued at \$147,125. Peach and nectarine trees of bearing age in 1910 numbered 39,342; those not of bearing age 30,795, and the production in 1909 was 17,701 bushels, valued at \$30,609. Pear trees of bearing age in 1910 numbered 16,907; those not of bearing age 5,405 and the production in 1909 was 12,501 bushels, valued at \$11,577. Other orchard fruits pro-

duced were: 1,872 bushels of plums and prunes, valued at \$3,586; 618 bushels of quinces, valued at \$1,267; and 214 bushels of cherries, valued at \$461.

The production of grapes in 1909 was 152,937 pounds, valued at \$9,759. The grape-vines of bearing age in 1910 numbered 7,662; those not of bearing age, 9,634. Nuts are of little importance, the production in 1909 being valued at \$49.

Strawberries are the most important of the small-fruits grown in Rhode Island. The acreage of strawberries decreased from 154 in 1899 to 140 in 1909, when the production was 326,540 quarts, valued at \$31,712. Cranberries decreased in acreage from 300 in 1899 to 70 in 1909, when the production was 34,688 quarts valued at \$2,734. Raspberries and loganberries decreased in acreage from 57 in 1899 to 34 in 1909, when the production was 32,871 quarts, valued at \$4,197. Other small-fruits produced in 1909 were: 17,875 quarts of blackberries and dewberries, valued at \$1,927; 17,110 quarts of currants, valued at \$1,564 and 8,251 quarts of gooseberries, valued at \$852.

Potatoes in Rhode Island decreased in acreage from 5,816 in 1899 to 4,619 in 1909 when the production was 552,677 bushels, valued at \$408,429. The more important of the other vegetables produced were: 790 acres of sweet corn, valued at \$49,440; 37 acres of celery, valued at \$26,880; 192 acres of cabbage, valued at \$25,818; 152 acres of onions, valued at \$23,828; 187 acres of tomatoes, valued at \$22,898; 196 acres of turnips, valued at \$21,050; 199 acres of cucumbers valued at \$18,330; 93 acres of asparagus, valued at \$17,504; 154 acres of beans, valued at \$13,305; 11 acres of lettuce, valued at \$14,670; 205 acres of peas, valued at 12,790; and 8 acres of radishes, valued at \$10,269. Vegetables valued at less than \$10,000 were beets, cantaloupes and muskmelons, carrots, cauliflower, eggplant, parsnips, green peppers, pumpkins, rhubarb, spinach, and watermelons.

The acreage devoted to the production of flowers and plants increased from 177 in 1899 to 290 in 1909. The total area under glass in 1909 was 2,027,643 square feet. Of this area 1,882,314 square feet were covered by greenhouses, and 145,329 by sashes and frames. The value of the flowers and plants produced in 1909 was \$558,543, as compared with \$314,806 in 1899.

The acreage devoted to nursery products increased from 86 in 1899 to 212 in 1909, when the value of the products was \$75,544, as compared with \$42,295, the value of the nursery products produced in 1899.

GEORGE E. ADAMS.

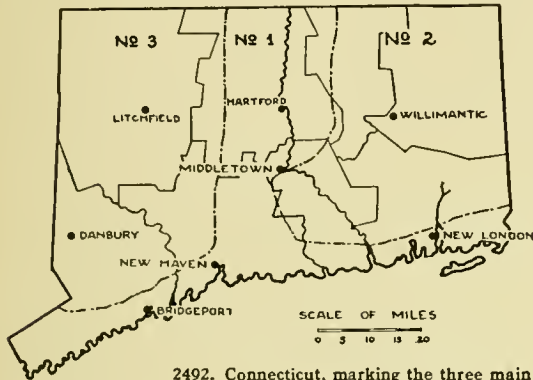
Connecticut.

While Connecticut (Fig. 2492) is one of the smallest states, covering but one degree of latitude (41° to 42°), it is adapted to as wide a range of horticultural productions as any state outside of the semi-tropic fruit-belt, owing to the great diversity of soil and varying elevations, from the sea-level along the whole southern border, to 900 and 1,200 feet in sections of Tolland County, and 1,200 and 1,500 in parts of Litchfield. The "season" of many of the quick-maturing species and varieties of fruits, flowers and vegetables is often entirely over on the light soil in the Connecticut Valley and along the Sound shore when like species and varieties are but just beginning to ripen on the cooler, moist soils of the hills of Tolland and Litchfield counties.

Strawberries and green peas from East Hartford and Glastonbury supply the Hartford market, while on the Bolton hills, only 12 miles away, the blooming vines give promise of the crop that is to come after the valley season is entirely over; so that "home-grown" strawberries are usually to be had in the Hartford market for a period of six or seven weeks. The Sound shore, Housatonic Valley and Litchfield hills supply

New Haven, Bridgeport and other cities of the state through equally long seasons.

From the earliest settlement of the state, fruit-growing for the family home-supply has been a prominent feature of Connecticut agriculture, the apple being a main reliance. The old seedling trees scattered over all our farms today are plain evidence that our ancestors took their apple-juice through the spigot of the cider-barrel rather than fresh from the pulp of the ripe fruit of some finer variety. A hundred years ago every farmhouse cellar wintered from thirty to fifty barrels of cider, while today it is hardly respectable to have any, and probably not one family in ten now has even



one single barrel on tap as a beverage. Yet in quantity and variety the family fruit-supply has wonderfully increased and a daily supply of fresh home-grown fruit is the rule rather than the exception in most farm homes,—small-fruits in variety, apples, pears, peaches, plums (both European and Japan), cherries and quinces, in all the best standard varieties, coming to their highest perfection in every section of the state when rational methods of culture are followed.

Natural timber and semi-abandoned farm- and pasture-lands, growing up to brush and timber, with increasing acreage yearly up to the beginning of the twentieth century, are now furnishing the "new lands" for extensive horticultural enterprises and many thousands of acres of these lands have been cleared and planted to peaches, apples and grapes within the past fifteen years, particularly in Hartford, Tolland, Middlesex and New Haven counties, mostly by newcomers from the north of Italy, although a few of the large developments have been made by old-time pioneer orchardists. Lying midway between New York and Boston, the greatest horticultural markets of America, Connecticut is better situated than any other state in the Union to realize quick cash returns from her horticulture. Every farm is within driving distance of some one or more of the busy manufacturing towns and villages, whose people are appreciative of choice fruits and are able to pay for them.

District No. 1 comprises the Connecticut River valley and adjacent hills, along the Northampton branch and the main line of railroad from Hartford to New Haven, and all of the shore towns. This region contains most of the sandy plain lands of the state, and the loams and clay most free from rocks and stones. On the hills back from the river, on the ridges either side of the railroads, and a few miles back from the Sound shore, there are many places where soil and topographical conditions are much the same as in districts Nos. 2 and 3; but, having much larger tracts of easily cultivated lands, and being better located as to market conditions, this district is more highly developed horticulturally than either of the others. Here are

the great market-gardens and small-fruit farms, peach-orchards, vineyards and melon-fields.

District No. 2 comprises Tolland and Windham counties and all of the Middlesex and New London counties, except Cromwell and the shore towns, and is particularly well suited to apple- and peach-culture, owing to the rolling condition of the country and natural fertility of many of the hills. Every few miles are little valleys and pockets suited to the production of small-fruits and vegetables in variety. A few townships in the northeast grow apples rather extensively, while in the west and southwest commercial peach-orchards are found to considerable extent.

District No. 3 comprises western Hartford, north-western New Haven, northern Fairfield, and all of Litchfield counties, and is somewhat similar to district No. 2, except that the soil is generally heavier, with rather more mixture of clay and the hills are more abrupt and rocky. Some sections of Litchfield County are too cold and bleak for any but the most hardy fruits. Apples grow freely everywhere, and, while always of good quality, the brightest colors, firmest texture and highest quality of fruit is produced on the rocky hills, at an elevation of 300 to 1,000 feet. Baldwin, Rhode Island Greening, Roxbury Russet and Spy are the leading varieties, although all the varieties that thrive well in the northeastern United States grow to perfection here when properly cared for, and in the new orchard developments of the past ten years, Wealthy, McIntosh, Banana and Delicious have been very extensively planted.

Peach-culture on an extended scale is a recent development. Thirty-five years ago the only commercial orchard in the state contained about 2,000 trees, and probably 5,000 trees would be a liberal estimate for the state at that time; now upward of 1,000,000 peach trees are grown in the state. While many varieties are grown, the main plantings are of Greensboro, Carnan, Hiley, Champion, Belle of Georgia and Elberta, of the North China type, an almost entire abandonment of the older Persian types as formerly grown, such as Mountain Rose, Oldmixon and the Crawfords. High culture, close pruning, spraying and a thinning of the fruit are generally practised, and fruit of brightest color, largest size and high quality is thus secured. In the markets of this and neighboring states, "Connecticut peaches" usually sell at a much higher price than those from any other section. The only serious drawback is the winter-killing of the fruit-buds in the valleys when temperature drops to 10° to 20° below zero, this happening probably two years out of five, while on many hill-sides and hilltops at least four crops out of five are assured; but there are many favorable localities where annual crops are almost a certainty.

Japanese plums, largely planted from 1895 to about 1905, were for a few years very vigorous, productive and profitable, Abundance, Burbank, and Red June being the most acceptable varieties. Of recent years, however, the trees have become very short-lived and their commercial planting has been almost entirely abandoned.

Raspberries, blackberries, currants and gooseberries grow and produce freely all over the state, and all local markets are abundantly supplied in season.

Grapes are grown successfully all over the state, except on the highest and coldest hills; and on the sandy plains and warm, rocky hillsides all the best standard varieties can be produced in perfection. There are a number of small vineyards in every county. There are many vineyards of three to ten acres in Hartford, Middlesex, New Haven and Fairfield counties, mostly owned by Italians, and grown for wine-making purposes, although in recent years many of the selected grapes from these vineyards find their way into market, where they sell at much higher prices than any from outside the state. Concord, Worden and Niagara are

varieties mostly grown for commercial and wine-making purposes, while almost the entire list of standard varieties can be and are grown in family vineyards.

Pears thrive and fruit well except on the lighter lands, and nearly every home-garden has from one to half a dozen trees. There are a few small commercial orchards in district No. 1, Bartlett and Clapp being most largely grown. At Hartford and the adjoining towns on the west side of the Connecticut River, the Bose is produced in its highest perfection.

Cherries have been steadily failing in the state for twenty-five years. Not enough are grown for home supply. Newly planted trees soon die out, and there is a general discouragement. They seem to do best in the vicinity of Middletown and Meriden, and the few commercial plantings there are quite profitable.

Quinces are grown all over the state for home supply, but thrive best along the Sound shore, where there are a large number of small commercial orchards.

Strawberries are very largely grown, both for home and outside markets, mostly in medium matted rows, with an average yield of eighty to ninety bushels an acre. Some cultivators, who follow the hill system or grow in narrow, thinly matted rows, secure 150 or more bushels an acre. In recent years some of the heavy wet hilltop lands in Hartford and Tolland counties have been cleared of stones and are producing late in the season heavy crops of extra-fine strawberries that in 1914 supplied the Hartford market with the very best of the whole year and it is reported that the returns to the growers were from \$600 to \$800 an acre.

A number of the berry farmers have systems of irrigation which add greatly to the surety of the crop, besides increasing the size and appearance of the fruit. The rolling character of the country and vast number of small streams abundantly supplied with water make it possible, at moderate expense, to irrigate many thousands of acres in this state, and the time is not far distant when the streams of Connecticut will be more valuable to her horticulturists than they ever were to her manufacturers in the old days of many small factories and water-wheels.

Almost from the earliest settlement, small local nurseries have abounded in the state and today number forty-one, with three quite extensive ones in Hartford, New Haven and Fairfield counties. At Cromwell, Middlesex County, is a floricultural establishment which, with one exception, has the largest area under glass of any such establishment in America, —some thirty acres,—and surpasses all others in the annual production of superb roses.

The late Judge A. J. Coe, of Meriden, was one of the first men in America to take up the new chestnut culture by the importation of the best foreign varieties and the selection of the best natives and their crosses. He began the grafting on native sprouts and seedlings, and fifteen to twenty years ago stimulated a general chestnut grafting, so that a number of chestnut orchards were being established on land too rough for cultivation, yet strong in its ability to grow the chestnut tree and nuts to perfection; but the chestnut blight of recent years is playing such havoc with all chestnut trees that for the present no further developments can be expected.

At Wethersfield, in Hartford County, Orange and Milford, in New Haven County, and Southport, in Fairfield County, are many farms devoted to seed-growing. Onion seed and sweet corn are the great specialties, but a great variety of other seeds are also grown, especially at Wethersfield and Orange.

Market-gardening is conducted extensively by specialists near all large towns and cities, while, with so many markets always close at hand, vegetables and fruits are sold in moderate quantities from nearly every farm. The largest market-garden farm is at New Haven, where over 400 acres are under annual cultivation with

vegetables and small-fruits. Twenty years ago at Southport, Fairfield and Westport, there were many farms, both large and small, devoted entirely to the production of onions. "Southport onions" were famous for fine appearance and quality, and nowhere in America was the annual yield so great or price received so high as in this district. Marketing was done in sailing vessels, direct from the farms to the dock markets in New York, where the onions were sold direct to retail dealers, boat captains acting as salesmen without commission for the sake of carrying the freight. For many years the net returns an acre were the greatest of any in the state. Being along the Sound shore and only fifty miles from New York, these valuable farm lands have in recent years been bought up for summer residents' property at \$2,000 to \$8,000 an acre, causing an entire abandonment of the once-prosperous onion business.

Trolley freight lines are widely extended through many farming sections of the state, and, running express cars at certain hours of the day with freight movements at night, they are growing to be a factor in the distribution of horticultural products.

Of the persons not now living who have had marked influence on the development of Connecticut horticulture may be mentioned: Theodore S. Gold, of West Cornwall; P. M. Augur, of Middlefield; Edwin Hoyt, of New Canaan; Richard Van Densen, of Enfield; A. J. Coe, of Meriden; Dr. Gurdon Russell, of Hartford; Albert Day, of Brooklyn; J. M. Hubbard, of Middletown; A. C. Sternburg, of West Hartford; John B. Smith, of New Britain; James B. Olcott, of Manchester; Miss Emily Moseley, of Glastonbury; and Mrs. John P. Bacon, of Danbury. Gold, Augur, Hoyt, Coe and Van Densen were fountain-heads of horticultural knowledge in regard to varieties of fruits and their adaptability to different sections at the time of the commercial awakening in the seventies and early eighties of the last century; while Miss Moseley might be said to have been the mother of the great commercial horticultural industries that center about Glastonbury, in Hartford County, and reaching out into Tolland and Middlesex counties, while the influence of Augur, Coe and Hubbard are clearly shown in the large orchard interests now centered about Middlefield and Wallingford. Gold and Hoyt had a wider influence the whole state over, and their works live after them in nearly every rural home at the present time.

Public-service agencies for horticulture.

The State Agricultural College at Storrs, in Tolland County, and the Connecticut Agricultural Experiment Station at New Haven, are the only two public-service agencies doing any work along horticultural lines. While the Experiment Station at New Haven has no horticulturist under that name, it has a botanist who devotes his time to a study of the diseases of all farm crops and the means of combating them, and can also give advice regarding the pruning, grafting and general care of orchards. An entomologist does the same work for insect pests that the botanist does for fungous diseases. The Station inspects yearly all nurseries in the state. There is a specialist on market-gardening and a plant-breeder. There have recently been issued three or four horticultural bulletins, a spray calendar and a short bulletin of specific directions for treatment of orchards, and two or more within the year on insect pests.

There is a school of horticulture at Hartford, and horticulture is taught in connection with agriculture in many of the high-schools.

The Connecticut Pomological Society, organized some thirty years ago, is a prominent feature in the lively fruit interests of the state, and at the present time has a paying membership of nearly a thousand members, making it the largest society in proportion to population of any state in the Union.

Statistics (Thirteenth Census).

The approximate land area according to the 1910 census is 3,084,800 acres. Of this, 70.9 per cent or 2,185,788 acres are in farms. The land in farms that is improved is 988,252 acres, or 45.2 per cent; the land that is in woodland, 757,743 acres, and other unimproved land in farms, 439,793 acres. The number of all the farms in the state in 1910 was 26,815. Their average acreage at that time was 81.5. [The total area of Connecticut is 4,965 square miles.]

The leading agricultural crops are cereals, hay and forage, tobacco, and forest products of the farms. The acreage in cereals in 1909 was 74,083, showing an increase of only 2,051 acres over that of 1899. The value of the cereals in 1909 was \$2,039,211 which was 9.1 per cent of the total value of all crops. The acreage of hay and forage in 1909 was 401,322, a decrease of 16.1 per cent from the acreage in 1899. The value of the hay and forage in 1909 was \$7,224,500, which was 32.1 per cent of the total value of all crops. Tobacco increased in acreage 58.5 per cent during the ten-year period. The acreage in 1899 was 10,119; in 1909, 16,042. The value of the tobacco products in 1909 was \$4,415,948 or 19.6 per cent of the total value of all crops. The value of the forest products from the farms in 1909 was \$1,861,853; in 1899, \$1,275,720.

The leading horticultural crops are potatoes and other vegetables, fruits and nuts, and flowers and plants and nursery products. Small-fruits are also of considerable importance. The acreage in potatoes has been changing constantly. In 1879 there were nearly 28,000 acres; there was a decrease of nearly 5,000 acres in 1889; an increase during the next decade, and a decline of over 3,000 acres between 1889 and 1909, leaving the acreage for 1909, 23,959. This acreage produced 2,684,414 bushels of potatoes, valued at \$1,882,197. Other vegetables increased in acreage 31.6 per cent from 1889 to 1909. The acreage in 1889 was 12,349; in 1909, 16,250. The value of these vegetable products in 1909 was \$1,965,635. The total value of fruits and nuts in 1909 was \$1,375,699; that of flowers, plants and nursery products, \$1,308,937. Small-fruits were also produced to the value of \$316,752, although the acreage decreased from 1,987 in 1899 to 1,597 in 1910.

More than four-fifths of the quantity of orchard fruits produced in 1909 were contributed by the apple. Peaches, nectarines and pears produced most of the remainder. The production of apples in 1909 was 1,540,996 bushels, valued at \$833,168; that of peaches and nectarines 269,900 bushels, valued at \$417,598; that of pears 41,322 bushels, valued at \$41,652. The other orchard fruits of lesser importance, their production and value in 1909 follow: plums and prunes, 13,663 bushels, valued at \$19,419; cherries, 3,617 bushels, valued at \$8,164; quinces, 4,627 bushels, valued at \$7,027.

In 1910, there were 107,054 grape-vines of bearing age in Connecticut and 61,670 vines not of bearing age. The grapes produced amounted to 1,317,682 pounds, valued at \$43,523.

The nuts of most importance in 1909 were the hickory-nuts and black walnuts. The number of hickory-nut trees of bearing age in 1910 was 3,792; those not of bearing age 5,355. The production was 64,124 pounds, valued at \$2,656. The number of black walnut trees of bearing age in 1910 was 3,188; those not of bearing age 2,636. The quantity produced was 45,304 pounds, valued at \$1,856.

Strawberries were by far the most important of the small-fruits grown in Connecticut, with raspberries and loganberries ranking next. The acreage of strawberries in 1909 was 993, as compared with 971 in 1899. The production was 3,016,295 quarts, valued at \$235,648. The acreage of raspberries and loganberries in 1909 was 289 acres and the production 384,256 quarts, valued at \$46,618. The acreage, production, and value of the

other small-fruits follow: 128 acres of blackberries and dewberries, producing 192,752 quarts, valued at \$16,869; 123 acres of cranberries, producing 145,408 quarts, valued at \$9,555; 54 acres of currants, producing 74,488 quarts, valued at \$7,056, and 9 acres of gooseberries, producing 9,023 quarts, valued at \$878.

Aside from potatoes, discussed above, the more important vegetables, their acreage, and value in 1909 were as follows: 165 acres of asparagus, valued at \$31,685; 167 acres of green beans, valued at \$21,426; 733 acres of cabbage, value of which was \$93,796; 159 acres of cantaloupes and muskmelons, the value of whose product was \$25,898; 185 acres of celery, the value of the product being \$55,142; 2,142 acres of sweet corn, the product valued at \$137,083; 282 acres of onions, the value of the product being \$38,156; 232 acres of green peas, the product valued at \$24,382; 85 acres of spinach, the product being valued at \$11,270; 621 acres of tomatoes, the product valued at \$115,654; and 742 acres of turnips, whose product was valued at \$40,968. Other vegetables grown were carrots, cauliflower, cucumbers, lettuce, green peppers, and watermelons.

In 1909, there were 560 acres occupied by flower and plant establishments as compared with 187 acres in 1899, an increase of 199.5 per cent. The area under glass in 1909 was 2,849,481 square feet, of which 2,636,063 were covered by greenhouses and 213,418 by sashes and frames. The total value of the flowers and plants in 1909 was \$1,047,431.

The acreage occupied by nursery establishments increased from 605 acres in 1899 to 770 in 1909, an increase of 27.3 per cent. The total value of the nursery products in 1909 was \$261,506. J. H. HALE.

MIDDLE ATLANTIC STATES.

New York.

By virtue of its many substantial interests in horticulture, New York (Fig. 2493) is preëminent in this division of agriculture among the states of the Union. Thus, New York ranks first or takes a high place in fruit-growing, truck- and vegetable-growing, the production of nursery stock, the growing of cut-flowers, and in the plant and seed trade for vegetables and flowers. To these horticultural crops of first magnitude must be added the culture of nuts and of medicinal herbs. These industries, divided into a great number of distinct horticultural occupations,—for the tendency is to specialize more and more,—probably occupy the time of more workers than any other form of husbandry in the state, though the monetary value of the products is less than that of cereal and forage crops or of dairy products.

Horticultural industries in New York take high rank chiefly because climate and soil are so diverse and so favorable as to make possible one of the most highly specialized areas of American farming, but also because in its commercial supremacy the state supplies unusual markets for the products. Thus, to consider the last factor first, more than 9,000,000 persons live within the borders of New York. In the state there are five cities with more than 100,000 inhabitants, sixteen with 25,000 to 100,000, and one hundred and twenty-seven with from 2,500 to 25,000. This vast and prosperous population is most varied, consisting of many nationalities of all gradations of wealth and employed in nearly all the means of livelihood known to mankind, so that there are diverse demands as well as extensive markets for horticultural products.

New York ranks twenty-ninth in land area among the states and territories of the United States. The state extends east and west 412 miles, north and south 310 miles. About one-twentieth of the state, chiefly comprising Long Island, lies below an altitude of 100 feet,

sixteen-twentieths between an elevation of 100 and 1,500 feet, while the mountainous regions of the Adirondacks and Catskills—three-twentieths of the total area—rise above 1,500 feet, the maximum altitude being above 5,000 feet in a few peaks in the Adirondacks. Excepting a small area in the south-western part, the surface of the whole state shows, in a marked degree, the effects of the erosions, drifts and moraines of the Ice Age.

The state is drained by five water-systems. Excess water in a small area in the southeast passes through

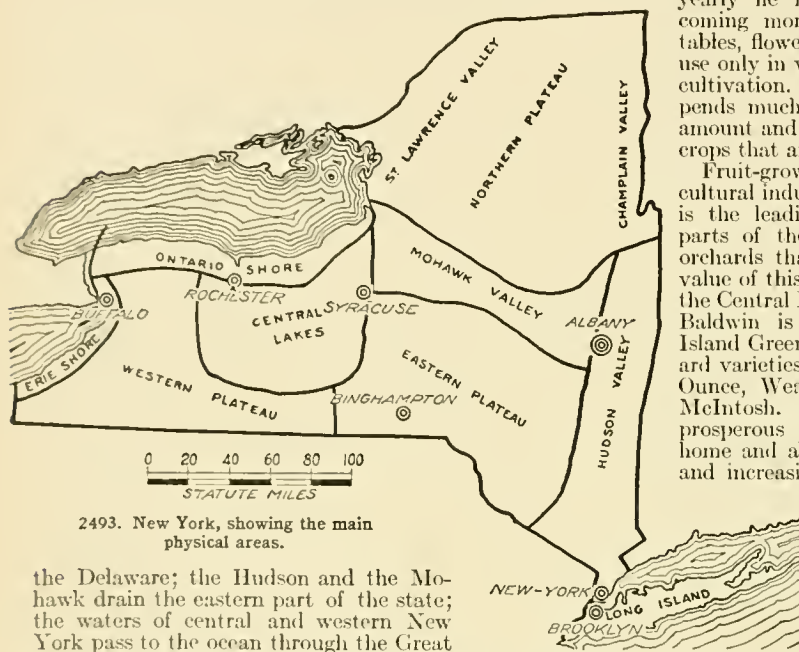
including a high escarpment; (8) the Erie shore, a narrow plain from the Niagara River to Pennsylvania, bounded on the north by the lake and on the south by a high escarpment; (9) the western plateau, comprising the area west of the basin of the Central Lakes and south of the Erie and Ontario shore regions.

The rainfall in New York is exceedingly variable, owing to the uneven surface of the land. It varies greatly, in some cases, even within the limits of a county, the annual precipitation being sufficient for most crops in one part, and in another drought may yearly lie heavily on the land. Irrigation is coming more and more into favor for vegetables, flowers and small-fruits, but, as yet, is in use only in very limited areas and with intensive cultivation. Specialization in horticulture depends much upon the rainfall, both the total amount and its distribution helping to decide the crops that are grown in a region.

Fruit-growing is chief of the several horticultural industries in New York, and the apple is the leading fruit. Apples are grown in all parts of the state, but the great commercial orchards that give New York first rank in the value of this fruit are found in the Ontario shore, the Central Lake and the Hudson Valley regions. Baldwin is the leading variety, with Rhode Island Greening a distant second. Other standard varieties are Northern Spy, King, Twenty Ounce, Wealthy, Oldenburg, Ben Davis, and McIntosh. The apple industry is in a most prosperous condition, with large demands at home and abroad for boxed and barreled stock and increasing demands for fruit at the many evaporators and cider mills in the state. Apple-culture in New York has been greatly stimulated by the general tuning up in agriculture everywhere experienced during the past quarter-century. Good care is now the rule, while but a short time ago it was the exception.

The grape is second to the apple in importance in New York. Exclusive of California, New York produces nearly half of the grapes grown in the United States, and the yield in Chautauqua County alone is many times more than that of any other state excepting California. The industry is centered in the Erie shore, Central Lake and Hudson Valley regions. On the Erie shore, several times as many Concordes are grown as all other varieties combined, the product going to the general markets and for the manufacture of grape-juice. About the Central Lakes, Catawba is the leading variety, a large part of the crop being used in the manufacture of wine and champagne. In the Hudson Valley, Concord, Delaware and Niagara are the leading varieties. The most striking feature in the grape industry at present is the rapid development in the manufacture of grape-juice, an industry which did not exist in 1900, but in which it is estimated more than 30,000 tons of grapes were used in 1915. Improvements in grape-culture have not kept pace with advances in growing other fruits, growers, in the main, cultivating too many acres from which they skim comparatively small returns.

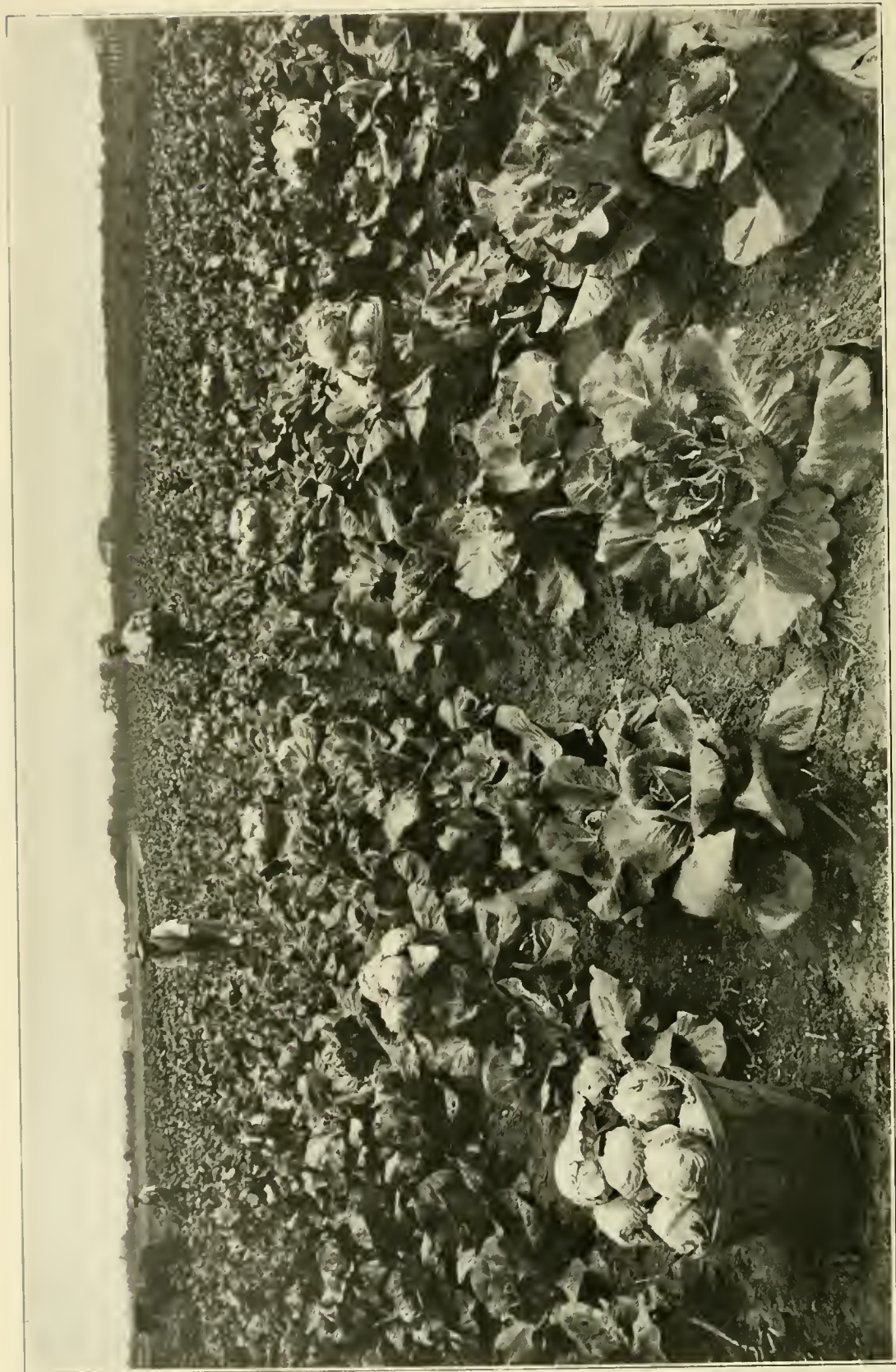
The peach takes third place in commercial importance among the fruits of New York. The industry is most highly developed along the shores of Lake Ontario, from Oswego west, but is also in very thriving condition about the Central Lakes and in the valley of the Hudson. Some peaches are grown on the grape lands bordering Lake Erie. Elberta is the mainstay in all commercial orchards in New York, with no close second. Peach-growing is a fine art in the state, and nowhere can finer orchards of this fruit be found.



2493. New York, showing the main physical areas.

the Delaware; the Hudson and the Mohawk drain the eastern part of the state; the waters of central and western New York pass to the ocean through the Great Lakes and the St. Lawrence; the drainage of the southwestern part is through the Allegheny into the Mississippi system; while the Susquehanna carries the waters of south-central New York into Chesapeake Bay.

Through its physical features, the state is divided into nine areas, which are somewhat distinct in natural vegetation and more or less so in their agriculture and horticulture. The nine regions are shown in the accompanying map. The great specialization to be noted in the horticulture of New York is largely accounted for by the differences in the soil and climate of these natural divisions. They are outlined as follows: (1) The Long Island district, a lowland plain, for most part, covered with a thick moraine deposit, in which sand predominates; (2) the Hudson Valley region, lying on both sides of the Hudson River from its mouth north to Lake George—a region of very uneven topography and of several geological formations so varied in soils and climate that in it several special horticultural interests have developed; (3) the St. Lawrence and Champlain region, consisting of high and rolling lands and valleys, adjacent to the St. Lawrence River and Lake Champlain, to which may be added the tillable land in the Adirondack Mountains; (4) the broad and fertile valley of the Mohawk from Oneida Lake to the Hudson; (5) the eastern plateau, consisting of the Catskills and the highlands to the west, reaching to the basin of the Central Lakes; (6) the great basin, in which lie the Central or Finger Lakes, large and deep bodies of water having great influence on the climate of the region; (7) the shore of Lake Ontario, from the St. Lawrence to Niagara River, extending from the lake inland several miles to and



LXXI. North American horticulture.—A commercial cabbage field in New Jersey.

Pears are more or less grown in all the apple regions of New York. Bartlett and Seckel are the staple sorts, with Bosc, Anjou, and Winter Nelis largely grown. While New York ranks first among the states of the Union in number of trees and value of product, yet pear-growing is a great risk because of the blight which few attempt to control and which annually takes tremendous toll.

Increased plantings of cherries in recent years give this fruit greater value than the plum, which long held higher commercial rank. Montmorency is the leading sour cherry. Early Richmond and English Morello are standard kinds. These are grown wherever the apple thrives. By far the largest part of the sour cherry crop goes to the canneries. Napoleon, Windsor, Schmidt, Governor Wood, and Black Tartarian are the sweet sorts most commonly grown, the product going almost wholly to fresh-fruit markets. Sweet cherries are planted only in the peach regions. Cherry-growing in New York, as elsewhere, has many ups and downs, sweet cherries being, possibly, more at the mercy of the seasons than other fruits, and both sweets and sour having to weather many depressions in prices.

The leading variety of plum is Bradshaw, with Reine Claude, Italian Prune, German Prune, Lombard, Shropshire Damson, and Grand Duke following in order of importance. The plum industry is almost wholly confined to the Ontario shore and Central Lakes regions. Abundance and Burbank, Japanese sorts, are widely planted and give general satisfaction. Native plums, even at the best, are so inferior to the domestic sorts that they are seldom planted. The development of rapid transportation and refrigerator service has enabled Pacific coast growers so to compete with New York that plum-growing seems now to be on a decrease in the state, though recent turns in the markets indicate increasing demands for New York plums, which are better flavored because there is not the need to pick before fully mature for shipment.

One-fourth of all the quinces grown in the United States come from New York. Orange is the standard variety. Apricots thrive in the peach lands of the state, but spring frosts take such heavy toll and the curculio is so aggressive that this fruit is seldom profitably grown.

New York stands first in rank in the value of small-fruit products, but in acreage falls below New Jersey. Small-fruits, excepting cranberries, the culture of which is confined to Long Island, are grown in all parts of the state. Black raspberries are largely grown in the Central Lakes region for evaporation, the annual output ranging from 1,200 to 1,500 tons. Strawberry-growing assumes large proportions.

Several factors greatly favor truck- and vegetable-growing in New York; as, proximity to markets, many means of transportation, the cheapness of labor (largely performed by women and children), the demands of the many canneries, and a large acreage of suitable soil. Long Island is the region of highest specialization in vegetable-growing, most of the cultivated land there being devoted to the culture of truck and seed crops; but vegetables are everywhere grown commercially, the industry becoming especially prominent on the many muck formations in various parts of the state. The vast quantity of truck is nearly all used within the state, much of it, however, being taken by the canneries, the product of which, of course, finds sale in considerable quantities outside of New York.

For nearly a century, western New York has been the center of the nursery trade in the United States. The trees and plants are grown in the Central Lakes and Ontario shore regions, but are distributed chiefly from Rochester, Geneva, and Dansville. The most significant thing in the recent development of the nursery business is the very great increase in the proportion of ornamentals. The nursery business has suffered

greatly from San José scale in the years just passed, but this pest has now been brought under control.

New York is also the center of the flower and plant trade of the United States. The floricultural and forcing interests are somewhat localized, though near every city and large town there are floral and forcing establishments. No doubt the greenhouse industry is most highly developed on Long Island, where roses, carnations and flowers for the retail trade are grown. Violet-growing is a thriving business at Rhinebeck on the Hudson. Vegetable-forcing thrives in and about Rochester. Large quantities of bulbs are grown on Long Island.

While there are but few commercial plantations of nuts in New York, the many trees about homes make a good showing for nut-growing in the state. In 1910, there were 164,333 bearing trees in New York; 51,239 not yet in bearing. Interest in nut-culture is yearly increasing.

Many vegetable and flower seeds are grown in New York, the state taking third place in the value of the product in 1909, the total value being \$72,991. The principal seed crops grown are bush-bean, brussels sprouts, cabbage, sweet corn, cucumber, kale, onion, pea, turnip, asparagus, and the seeds of a considerable number of flowers, of which New York leads in the production of aster seeds.

Ginseng-culture is profitably carried on in several counties in the state. The value of the product in 1909 was \$27,138, giving New York first place among the states of the Union.

The history of horticulture, as well as of countries, is that of its great men. So measured, New York has contributed much to American horticulture. The following is a partial roll-call of her eminent men in this profession not now living: C. L. Allen, seedsman, florist and author; Patrick Barry, nurseryman, editor, and author; Thomas Bridgeman, gardener, florist, seedsman, and author; E. S. Carman, editor and experimenter; John Craig, horticulturist and educator; A. J. Downing, landscape gardener and pomologist; Charles Downing, pomologist and author; George Ellwanger, nurseryman; Peter Henderson, florist, seedsman and author; F. M. Hexamer, nurseryman and editor; Jacob Moore, plant-breeder; Samuel B. Parsons, landscape gardener and author; William Prince (I), nurseryman; William Prince (II), nurseryman and author; William Robert Prince, nurseryman and author; A. M. Purdy, horticulturist and author; J. J. Thomas, pomologist and author; Grant Thorburn, seedsman; Luther Tucker, editor; Calvert Vaux, landscape gardener; and James Vick, seedsman and editor. See Volume III for biographies.

Public-service agencies for horticulture.

The State College of Agriculture was established in 1904 at Ithaca. Before this time, however, agriculture had been taught as a department in Cornell University. There are nineteen members of the horticultural staff.

Two experiment stations are doing research work in horticulture for the state. In 1879, the Cornell University Agricultural Experiment Station was organized at Ithaca. In 1888, this institution, one of the first of its kind in North America, was reorganized as a federal station. The New York Agricultural Experiment Station, located at Geneva, was established in 1882, and is supported by the state. Both stations give special attention to horticultural problems.

Horticultural education is provided for in a number of high-schools in the state; in secondary schools of agriculture at Alfred, Canton, and Morrisville.

Extension work in horticulture is also carried on in the state, through schools, farmers' institutes, and the like.

The various horticultural interests are nearly all organized into trade or educational societies, the time

having long since passed when all could be represented in one organization. The first of these societies was the New York Horticultural Society, founded in New York City in 1818, long since extinct, probably the first organization of the kind in North America. In 1829 the Albany Horticultural Society was organized, but was short-lived. February 27, 1855, the Western New York Horticultural Society, now the oldest such society in the state, was organized, with headquarters at Rochester. February 27, 28, 1910, the New York State Fruit-Growers' Association was organized at Syracuse. The two societies named last have larger membership lists than any similar organization in North America. The nurserymen of the state have long had a trade organization, and the vegetable-growers are represented by the New York State Vegetable-Growers' Association, founded in 1913.

The State Department of Agriculture, at Albany, provides inspection service to control insects, diseases, fruit-grading, and fertilizers.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 30,498,560 acres. The amount of this area that was in farm land in 1910 was 22,030,367 acres. Of this land in farms, 14,844,039 acres were improved; 4,436,145 were woodland; and the unimproved land in farms numbered 2,750,183 acres. The number of all the farms in 1910 was 215,597, and the average acreage a farm was 102.2. [The total area of New York is 49,204 square miles].

The leading agricultural crops are cereals, hay and forage, and forest products. In 1909, the acreage of cereals was 2,602,461, as compared with 3,125,077 in 1899, and the value of the cereals in 1909 was \$43,099,988. Hay and forage decreased in acreage from 5,154,965, in 1899, to 5,013,373 in 1909, a decrease of 2.2 per cent. The value of hay and forage in 1909 was \$77,360,645. The value of the forest products of the farms in 1909 was \$10,365,651, as compared with \$7,671,108 in 1899, showing an increase in value of 35 per cent.

Horticultural crops grown in New York are fruits and nuts, potatoes and other vegetables, small-fruits, flowers and plants, and nursery products. The value of the fruits and nuts in 1909 was \$22,024,996, as compared with \$13,377,105 in 1899, showing an increase in value of 64.6 per cent. The acreage of potatoes in 1909 was 394,319, as compared with 395,640 in 1899, and the value of the potatoes produced in 1909 was \$20,338,766. Excluding potatoes, the acreage of other vegetables increased from 144,318, in 1899, to 175,402 in 1909, an increase of 21.5 per cent, and their value in 1909 was \$15,963,384. The acreage of small-fruits in 1909 was 22,496, as compared with 25,051 in 1899, a decrease of 10.2 per cent, and their value in 1909 was \$2,875,495. Flowers and plants and nursery products increased in acreage from 9,731, in 1899, to 11,659 in 1909, an increase of 19.8 per cent, and their value was \$7,899,906.

The total quantity of orchard-fruits produced in 1909 was 29,456,291 bushels, valued at \$17,988,891. Apples contributed about six-sevenths of this quantity, there being produced in 1909, 25,409,324 bushels, valued at \$13,343,028. The number of apple trees of bearing age in 1910 numbered 11,248,203; those not of bearing age numbered 2,828,515. Peach and nectarine trees of bearing age in 1910 numbered 2,457,187; those not of bearing age, 2,216,907, and the production in 1909 was 1,736,183 bushels, valued at \$2,014,088. Pear trees of bearing age in 1910 numbered 2,141,596; those not of bearing age, 1,502,661, and the production in 1909 was 1,343,089 bushels, valued at \$1,118,218. Other orchard-fruits produced in 1909 were: 553,522 bushels of plums and prunes, valued at \$519,192; 271,597 bushels of cherries, valued at \$541,508; 132,451

bushels of quinces, valued at \$135,345; and 9,805 bushels of apricots, valued at \$14,490.

The total production of nuts in 1909 was 2,773,858 pounds, valued at \$74,420. The more important productions of the various nuts were 286,227 pounds of chestnuts, valued at \$23,589; 1,519,279 pounds of butter-nuts, valued at \$21,631; 487,768 pounds of hickory-nuts, valued at \$16,742; 465,918 pounds of black walnuts, valued at \$11,485; and 9,346 pounds of Persian or English walnuts, valued at \$858.

The number of grape-vines of bearing age in 1910 was 31,802,097; those not of bearing age, 3,801,800. The production of grapes in 1909 was 253,006,361 pounds, valued at \$3,961,677, thus forming an important industry.

Of the small-fruits grown in New York, strawberries, raspberries and loganberries are the most important, with currants ranking next. The acreage of strawberries decreased from 7,311, in 1899, to 6,382 in 1909, when the production was 15,945,863 quarts, valued at \$1,187,110. Raspberries and loganberries decreased in acreage from 12,376, in 1899, to 11,057 in 1909, when the production was 14,751,940 quarts, valued at \$1,168,062. Currants decreased in acreage from 2,594, in 1899, to 2,557 in 1909, when the production was 3,982,389 quarts, valued at \$264,051. The production of other small-fruits in 1909 was 2,509,851 quarts of blackberries and dewberries, valued at \$210,986; 331,135 quarts of gooseberries, valued at \$23,427; and 327,370 quarts of cranberries, valued at \$20,743.

The value of vegetables, produced in 1909, excluding the potato, was \$15,963,384, not exceeded by any other state in the United States in value of vegetable products. The leading vegetables grown in 1909 were: 35,269 acres of cabbage, valued at \$2,335,999; 2,926 acres of celery, valued at \$946,424; 23,739 acres of sweet corn, valued at \$942,023; 5,558 acres of onions, valued at \$954,610; 16,992 acres of green peas, valued at \$815,256; 8,636 acres of tomatoes, valued at \$775,803. Other important vegetables grown in 1909 were asparagus, green beans, beets, carrots, cauliflower, lettuce and turnips, spinach, rhubarb, radishes, parsnips, horse-radish, cucumbers, cantaloupes, and muskmelons.

New York ranks first among the states in the production of flowers and plants. The acreage devoted to this industry increased from 1,496, in 1899, to 2,979 in 1909. The area under glass in 1909 was 15,066,587 square feet, of which 13,876,857 were covered by green-houses and 1,189,730 were covered by sashes and frames. The value of the flowers and plants produced in 1909 was \$5,148,949, as compared with \$2,867,673 in 1899.

New York also ranks first in the value of nursery products produced. The acreage devoted to this industry increased from 8,238, in 1899, to 8,680 in 1909. The value of the nursery products in 1909 was \$2,750,957, as compared with \$1,642,107 in 1899.

U. P. HEDRICK.

New Jersey.

Considering its area, New Jersey (Fig. 2494) is wonderfully favored in its range of soil and climatic conditions. In the northern part, the land is rolling and hilly, with areas rich in lime and mineral plant-food, and with climatic conditions suitable for such apples as the Baldwin and Greening. South of this hilly area is a plains region crossing the counties of Somerset and Hunterdon, where varieties requiring a little longer season should be grown. The southern half of the state has soil types varying from clay loams to the lightest sand, offering ideal conditions for the growing of all crops from the sweet potato to celery, corn and grass, and from the cranberry to the peach. The southern counties have conditions resembling those of the Delaware and Maryland peninsula and early truck crops can

be grown to good advantage. The northern counties have conditions resembling parts of New York and New England.

Situated between the greatest markets on the Atlantic seaboard, and near numerous industrial centers, the lands of the state are intensively cultivated to yield a great variety of horticultural products.

Vegetable and truck crops are produced to exceed a value of \$7,000,000 annually, exclusive of potatoes and sweet potatoes. In the southern counties, the industry is conducted upon an extensive trucking basis, and such

atoes is a common daily shipment at the height of the season, and during July, 1912, more than 400,000 crates were shipped by rail to distant points, while large quantities were sold in Philadelphia and other nearby markets. One day's shipment of tomatoes from Swedesboro in 1910 comprised 36,000 crates and 25,000 baskets. The industry about Swedesboro has become a specialty in the production of early tomatoes to be placed on the market after the southern crop has been shipped. Earliana is the variety almost exclusively grown.

Tomatoes are also grown very extensively outside the Swedesboro district. The reported acreage in New Jersey in 1910 was about one-eighth the reported acreage of the entire country and the value of the New Jersey crop was estimated to be about one-sixth the value of the crop in the United States. New Jersey tomatoes are consumed in large quantities in the smaller towns and cities of the state as well as at the large seashore resorts. Soil conditions are favorable to the production of tomatoes at no great distance from these local markets and they are kept well supplied throughout the season. Along the Delaware River, tomatoes are shipped by boat to Wilmington, Baltimore and Philadelphia. Refrigerator cars are employed for distant shipments by rail to such points as Boston, Pittsburgh, and Chicago. A few shipments are even made to markets as far south as Florida.

Another prominent feature of the tomato industry is the canning business. Large areas of tomatoes are grown under contract for the canning trade. Prices for canning tomatoes commonly range from \$8 to \$10 a ton. The medium- and late-crop tomatoes are the ones used for canning, and such varieties as Bonny Best, Cumberland, Stone, and Greater Baltimore are the most popular. The plant of the Campbell Soup Company is at Camden, and vast quantities of tomatoes are contracted for and purchased throughout southern New Jersey. At the height of the season, long lines of market wagons loaded with 175 to 250 baskets of tomatoes can be seen going into Camden.

Tomatoes are not the only vegetables that are canned in the state. More than fifty canning factories were in operation in central and southern New Jersey in 1912, and peas, beans, beets, sweet potatoes, and other vegetables are canned annually. The acreage and value of many vegetable crops are large in the state.

The floricultural interests of the state are great and products amounting to more than \$2,850,000, are produced annually. The center of this industry is in Morris, Essex and Hudson counties, but with large individual plants at Riverton and other points.

Orchard-fruits are produced at an annual value exceeding \$1,975,000. The introduction of the San José scale caused great damage to the orchards about 1900, but the culture of these fruits is now progressing as never before. Monmouth, Burlington and Gloucester counties now lead in the production of apples. Such varieties as Yellow Transparent, Duchess of Oldenburg, Williams, Gravenstein, English Codlin, Starr, Wealthy, Twenty Ounce, McIntosh, Grimes, Stayman, Baldwin, Rome, Delicious and Arkansas (Paragon) comprise a good commercial list for the state. The summer and fall varieties prove to be as profitable as the winter apples, and are being planted liberally.

Peach-production is increasing very rapidly upon modern lines. About the year 1900 the counties in the northwestern part of the state were leaders, but at present Burlington and Monmouth are assuming the lead with Gloucester, Atlantic and Cumberland making rapid strides. Annual plantings of 20,000 to 30,000 trees are being made about small centers where only an average of 4,000 to 8,000 trees were planted in 1908 and 1909. There has been a marked change in the popularity of varieties also. At one time Mountain Rose, Early Crawford and Reeves were leading commercial sorts, but today the list would be selected from such



2494. New Jersey. 1, apples; 2, peaches; 3, pears; 4, bush-fruits; 5, strawberries; 6, grapes; 7, floriculture; 8, truck crops; 9, cranberries.

crops as tomatoes, peppers, eggplants, melons, sweet corn, beans and sweet potatoes are largely grown. In the counties of Essex, Hudson, Bergen and Passaic, the industry is of the intensive type, and upon more limited areas.

Large areas in the southern half of the state consist of sandy loam soil types which warm up quickly in the spring, are easily worked, quick to respond to good management and ideal for the production of early vegetables upon an extensive scale. An extensive trucking area extends from just south of Bordentown along the Delaware River to Palmyra. Early peas, beans, sweet corn, rhubarb, asparagus, and other vegetables are grown in succession and companion cropping systems. Another characteristic of this section is the large number of young peach, apple and cherry orchards intercropped with vegetables. Another large trucking area centers about Moorestown. Fruit and vegetables are the important crops upon many farms in this region.

Swedesboro is the center of the great tomato and sweet potato section in Gloucester County, and is one of the leading shipping stations for vegetables in the United States. From fifty to sixty carloads of toma-

varieties as Greensboro, Carman, Lola, Hiley, Belle, Elberta, Frances, Iron Mountain and Krummel. Shipments were made in sixteen-quart baskets almost exclusively about 1900, but the Georgia carrier is now preferred for shipments by rail. The sixteen-quart and twenty-quart baskets are still used extensively where the fruit is hauled direct to the Philadelphia and local markets.

Pears are still grown in large quantities in Burlington, Gloucester, Camden and Monmouth counties, but apples and peaches have received more attention since the pear-blight appeared. In spite of this disease, however, the industry is holding its place. Such sorts as Bartlett, Seckel, Kieffer, Duchess and Lawrence are the most widely grown.

Plums are not being planted to any extent commercially. Most of this fruit is now produced in Bergen, Somerset and Morris counties.

The planting of sour cherries is on the increase, especially in Burlington and in counties south of it. Early Richmond and Montmorency are the most popular sorts.

Sweet cherries are planted to a limited extent only. Quinces are just beginning to receive attention commercially under modern methods and increased plantings are likely to be made each year.

The annual production of small-fruits holds nearly equal rank to that of the tree-fruits in New Jersey with a total area exceeding 24,000 acres. And of these the strawberry leads with an acreage exceeding 8,600 acres. Cumberland, Burlington and Atlantic counties lead in the production of this fruit.

The cranberry industry is the most extensive of any state in the Union. Over 9,000 acres are devoted to this crop. The features of the industry are the development of distinct varieties and the fertilizing and spraying of the bogs. This industry is centered in Burlington, Atlantic and Ocean counties.

Blackberries, dewberries and raspberries are extensively grown in all the southern counties of the state. The center of the industry is in Atlantic County about Hammonton. The Ranere (St. Regis) raspberry is said to have originated in this district. Ward is the most popular variety of blackberry, and Lucretia is the only dewberry grown to any extent. Currants and gooseberries are being planted in larger quantities, especially in Burlington, Monmouth, Camden and Bergen counties. Red Cross, Fay and Wilder are leading commercial currants, while Downing leads as a gooseberry.

The planting of vineyards is increasing. Large numbers of small vineyards are being set by Italian farmers in Atlantic, Cumberland and Gloucester counties. Vineyards of 100 acres or more in extent occur in Cumberland and Camden counties. The most popular varieties are Concord, Ives, Niagara, Diamond and Moore Early.

The motor-truck is becoming an important factor in New Jersey horticulture. Some fruit-growers and truckers are becoming independent of the railroads in getting their produce to market.

The following men did much to advance horticulture in New Jersey in early years: George Thurber, Passaic; E. Williams, Montclair; W. R. Ward, Lyons Farms; Joseph Ward, Lyons Farms; Patrick Quinn, Newark; Peter Henderson, Jersey City; Col. A. T. Pearson, Vineland; William Parry, Cinnaminson, and John Repp, Glassboro.

Public-service agencies for horticulture.

The land-grant college of New Jersey was established at New Brunswick in 1864 in connection with Rutgers College. There are now three men on the horticultural staff.

Both the College Station and the State Experiment Station are located in New Brunswick. The State

Station is the only one conducting special horticultural investigations at the present time, and the staff consists of seven men. Much plant-breeding work with vegetables is being conducted at the College Experiment Station, which can be classed as either botanical or horticultural. Extensive peach investigations are conducted in different parts of the state but principally at Vineland where about 12 acres of land are leased by the Station. Eight bulletins have been issued relative to fruit-culture; thirteen to vegetable crops and one relative to both; thirty-six bulletins to insects injurious to fruits and vegetables; fourteen to diseases of fruits and vegetables, and one to both insects and diseases of fruits and vegetables. Five circulars and special bulletins have been issued in regard to fruit, three upon vegetable crops and ten upon insects and diseases affecting vegetable crops. One bulletin upon rose-culture is now ready for issue.

Three vocational schools have just been established in Atlantic County in which horticulture is taught. Horticulture is also taught in a few of the high-schools, especially at Freehold.

There is no provision made for horticulture in any state department at present. Extension work in horticulture is being conducted by one specialist and assistant in fruit-growing and one specialist in market-gardening.

Inspection of nursery stock for insects and diseases is in charge of the State Entomologist, and the State Plant Pathologist, who are both members of the Station staff.

The New Jersey State Horticultural Society has been an important factor in the progress of horticulture in New Jersey. This Society was organized August 17, 1875, at New Brunswick. George Thurber was elected as first president. A vegetable section was formed in December, 1914, in order to bring about coöperation between the trucking and fruit interests.

Statistics (Thirteenth Census).

The approximate land area of New Jersey in 1910 was 4,808,960 acres. The land in farms was 53.5 per cent of the land area, or 2,573,857 acres. Of this area in farms, 1,803,336 acres were improved land; 538,131 acres were in woodland; and 232,390 acres was other unimproved land in farms. The number of all the farms in 1910 was 33,487 and the average acreage to the farm 76.9. [The total area of the state is 8,224 square miles.]

The leading agricultural crops are cereals and hay and forage. The acreage devoted to cereals decreased from 588,853 in 1899 to 503,651 in 1909, when the value of the production was \$9,797,937. Hay and forage decreased in acreage from 444,610 in 1899 to 401,315 in 1909, when the production was valued at \$7,627,402. The value of the forest products of the farms in 1909 was \$758,515, as compared with \$469,055 in 1899.

Horticultural crops produced in New Jersey are fruits and nuts, small-fruits, vegetables including potatoes and sweet potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$2,115,321 as compared with \$2,697,399 in 1899. Small-fruits decreased in acreage from 25,350 in 1899 to 24,069 in 1909, when 38,822,987 quarts were produced, valued at \$1,954,125. In 1909 the total acreage of vegetables, including potatoes and sweet potatoes, was 181,722, and their value \$14,073,467. Vegetables, excluding the potato and sweet potato, increased in acreage from 77,779 in 1899 to 86,227 in 1909, when the production was valued at \$7,566,493. It is thus seen that the raising of vegetables is a very important industry in New Jersey, as 34.9 per cent of the total value of all crops in 1909 was produced by the vegetables, including potatoes. The raising of flowers and plants and nursery products is of considerable importance, the acreage having increased from 2,395 in 1899 to 3,603 in 1909, when the production was valued at \$3,539,523.

The production of orchard fruits in New Jersey in 1909 was 2,372,358 bushels, valued at \$1,975,044. Apples produced nearly three-fifths of this quantity, peaches and nectarines and pears most of the remainder. The production of apples in 1909 was 1,406,778 bushels, valued at \$956,108. The number of apple trees of bearing age in 1910 was 1,053,626 and those not of bearing age 519,749. Peach and nectarine trees of bearing age in 1910 numbered 1,216,476; those not of bearing age, 1,363,632, and the production in 1909 was 441,440 bushels, valued at \$652,771. The number of pear trees of bearing age in 1910 was 731,616; those not of bearing age, 238,401, and the production in 1909 was 463,290 bushels, valued at \$254,582. Other fruits produced in 1909 were: 44,636 bushels of cherries, valued at \$87,225; 9,594 bushels of plums and prunes, valued at \$13,476; 6,442 bushels of quinces, valued at \$10,583; and 178 bushels of apricots, valued at \$299.

The production of grapes increased from 4,235,000 pounds in 1899 to 6,501,221 pounds in 1909, valued at \$132,957. The grape-vines of bearing age in 1910 numbered 1,603,280; those not of bearing age, 558,945.

The total production of nuts in 1909 was 249,626 pounds, valued at \$7,116. The production of the more important of the individual nuts was 151,828 pounds of black walnuts, valued at \$2,766; 62,243 pounds of hickory-nuts, valued at \$2,468; and 25,987 pounds of chestnuts, valued at \$1,413.

Strawberries are the most important of the small-fruits grown in New Jersey, with cranberries second in importance. The acreage of strawberries decreased from 8,746 in 1899 to 8,684 in 1909, when the production was 18,767,473 quarts, valued at \$929,108. The acreage of cranberries increased from 8,356 in 1899 to 9,030 in 1909, when the production was 12,072,288 quarts, valued at \$504,026. The acreage of blackberries and dewberries decreased from 5,254 in 1899 to 4,332 in 1909, when the production was 5,456,789 quarts, valued at \$313,480. Raspberries and loganberries decreased in acreage from 2,240 in 1899 to 1,744 in 1909, when the production was 2,143,877 quarts, valued at \$178,579. The production of gooseberries in 1909 was 221,337 quarts, valued at \$16,171; and that of currants 161,223 quarts, valued at \$12,761.

The potato industry increased from an acreage of 52,896 in 1899 to 72,991 in 1909, when the production was 8,057,424 bushels, valued at \$4,979,900. The sweet potato and yam acreage increased from 20,588 acres in 1899 to 22,504 in 1909, when the production was 3,186,499 bushels, valued at \$1,527,071. Of the other vegetables produced in New Jersey in 1909, the more prominent were: 26,552 acres of tomatoes, valued at \$2,131,973; 5,148 acres of asparagus, valued at \$602,317; 10,442 acres of sweet corn, valued at \$557,708; 4,864 acres of cabbage, valued at \$368,454; 3,861 acres of cantaloupes and muskmelons, valued at \$306,073; 3,740 acres of green beans, valued at \$238,149; 4,912 acres of green peas, valued at \$208,934; 621 acres of celery, valued at \$201,735; 1,417 bushels of onions, valued at \$171,344; and 2,226 acres of watermelons, valued at \$137,584. Other vegetables produced were beets, carrots, cauliflower, cucumbers, eggplant, horseradish, lettuce, parsley, parsnips, green peppers, pumpkins, radishes, rhubarb, spinach, squash and turnips.

The acreage devoted to the flower and plant industry increased from 613 in 1899 to 1,436 in 1909. The area under glass in 1909 was 8,840,511 square feet, of which 7,984,752 were covered by greenhouses and 855,759 by sashes and frames. The value of the flowers and plants produced in 1909 was \$2,857,709.

Nursery products increased in acreage from 1,782 in 1899 to 2,167 in 1909, when the nursery products were valued at \$681,814, as compared with \$339,926 in 1899.

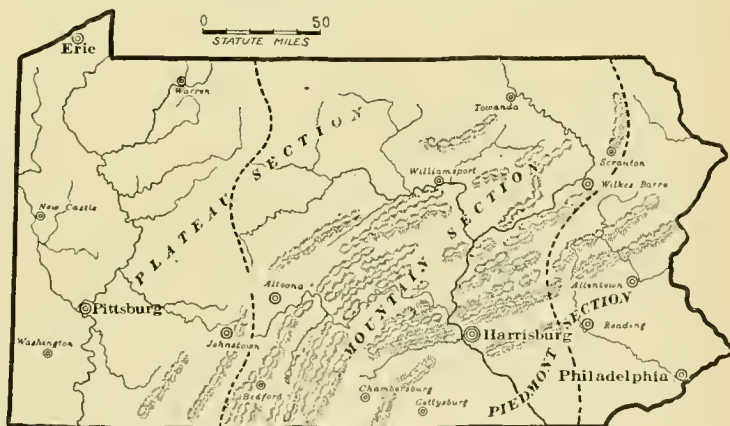
M. A. BLAKE.

Pennsylvania.

Pennsylvania (Fig. 2495) is the second state in the Union in population, although only the thirty-second in size. It is located between parallels 39° 40' and 42° north, and in longitude between 75° and 80° 30' west. It is roughly rectangular in shape, averaging 285.8 miles in length and 157.8 miles in width, about 65 per cent of its area being in farms. The large unfarmed area remaining is due chiefly to the fact that the entire Appalachian system swings diagonally across the state, leaving most of it rough and mountainous. It is also partly due to the great strength of the coal-mining and the gas, petroleum and lumbering industries, some of which, however, are now on the wane. In altitude, the state varies from practically sea-level in the Philadelphia section to a height of nearly 3,000 feet in the central mountain and plateau region, and then sinks again to about 600 feet above sea-level along the Lake Erie shore.

The precipitation varies considerably in different localities, owing largely to their relation to the adjacent mountains, but in general it is satisfactory. Towanda is in one of the lowest sections, with an annual average of only 34.6 inches. From this, the average rises to 38.2 inches at Erie and to 40.9 inches annually at Philadelphia. At Pittsburgh, State College and Harrisburg, the averages have been 36.2, 38.9, and 36.9 inches respectively, over observation periods ranging from twenty to sixty-three years. At State College, the extremes during the last thirty years have been 25.2 and 45.8 inches.

The annual temperatures also naturally vary considerably as a result of mountain or of water influences. At representative points in the state the records show the following averages over long periods: Erie, 48.8°; Pittsburgh, 52.7°; State College, 48.6°; Towanda,



2495. Pennsylvania, showing the three main sections.

47.8°; Harrisburg, 51.6°; and Philadelphia, 52°. Similarly the records show that the average growing season, or the average period between killing frosts, is especially variable, showing the great influence of altitude or of large bodies of water on the average length of the frost-free period.

Looking at the general surface of the state in greater detail, it is seen that it is divided into three great sections. The first of these lies east and south of the Blue Mountains, which run in a broad curving line from Franklin County around north of Harrisburg to the northern side of Northampton County. This section

has a generally rolling to hilly topography, broken by a few irregular low mountain groups, of which the South Mountains, Welsh Mountains and the Reading Hills are most prominent. This was the region first settled, and it is now mostly under cultivation and contains probably the best lands of the state. It includes the small coastal plain region, the Piedmont plateau, and a part of the Limestone Valley and Alleghany Mountain provinces, the latter of which crops out in the low mountain groups referred to above.

The second section extends from the Blue Mountains to the Alleghany escarpment, which runs from Somerset County around west of Altoona, slightly north of Williamsport and on eastward in reduced form through Lackawanna and Wayne counties. In general form, this section is a large crescent, about 50 to 60 miles in width, and comprises about a fourth of the state. It consists of a numerous succession of parallel mountain ranges, derived from hard sandstones and separated by comparatively narrow valleys which have been carved out from shales or soft sandstones. It includes parts of the Alleghany Mountain, Limestone Valley, and glacial provinces. The broader valleys in this section, especially those of limestone origin, are fertile and well adapted to general farm crops, but the hills and mountain slopes are usually stony and more or less barren.

The third or plateau section lies west and north of the Alleghany escarpment and includes about 55 per cent of the area of the state. It consists of a much-dissected plateau, broken by occasional mountain ridges, and deeply scored by frequent streams or cañons, some of the latter being as much as 800 feet deep in the northern part, where the general elevation is greatest. Most of this area is distinctly mountainous in character. It has been very largely in forests, and much of it has been cleared so recently that but little has yet been accomplished toward its utilization along other lines. The soils of the DeKalb series are much the most extensive in this general region, though the Westmoreland, Upshur, and Berks soils are fairly prominent. The general location and adaptations of these and all other important soils in the state, are well given in a recent Bulletin, No. 132, by C. F. Shaw, from the Pennsylvania Station.

From the horticultural viewpoint, there is probably no state in the Union with greater possibilities than Pennsylvania. Its general location, large population, wide range of soils and almost unlimited choice of topography within relatively small areas, offer advantages that are very difficult to equal elsewhere. These advantages have only begun to be realized, however, and although the production is already large along many lines, it has generally been due to the large aggregate of relatively small growers producing for local markets, rather than to any large and well-managed commercial efforts. The present development, therefore, must be regarded only as a beginning.

In total value of horticultural products, Pennsylvania usually ranks third, being preceded by California and New York and followed by Michigan. In 1909, Michigan forged slightly ahead in total value of fruit, but even in that year the shortage in fruit was much more than made up by the difference in vegetables, flowers and nursery products, and with the latter included the state easily secured third place with a margin of more than \$1,500,000.

Among the specific horticultural crops, apples are probably the most cosmopolitan, since they usually thrive in almost any part of the state where both local conditions and varieties have been properly selected. They contributed about five-sixths of the total orchard production in 1909. Both apples and peaches do especially well in proper locations over the entire Piedmont section of southeastern Pennsylvania, referred to above. They are also grown with special

success on many of the foothills and more gentle slopes of the eastern and southern ranges of the Appalachian system. In Erie County, the narrow glacial lake area in the extreme northwestern part of the state is being rapidly developed for the production of grapes and peaches especially, with considerable commercial interest also in apples, cherries, plums and vegetables. This county is distinctly in the lead in horticultural products as a whole, and is followed in order by Lancaster and York, whose high totals are due chiefly to their large vegetable-production. In apples, however, the most intensive commercial area at present is the one in Adams County, although there are a number of other localities in the state where the natural advantages are fully as good, as shown by the marked success of individual orchards.

Many important varieties of fruits have originated in Pennsylvania, some of them now being grown widely. Among apples, the most important are as follows: York Imperial, Smokehouse, Rambo, Cornell (Fancy), Sweet Winesap, Smith (Cider), Jefferis, Ewalt (Walker Beauty), Major, Minkler, Winter Sweet Paradise, York Stripe, Winter Blush, Fallawater, Early Ripe, Doctor, Belmont, Strode (Birmingham), Wine, Cooper Market, Dickinson, Evening Party, Golden Spy, Krauser, and Lehigh (Greening). Altogether, Pennsylvania is credited with the origin of no less than 314 varieties of apples.

Among the pears, the following are the most important that have originated in Pennsylvania, viz., the Seckel, Tyson, Rutter, Brandywine, Kieffer, Garber and Ott. Of the plums, the most important of Pennsylvania origin are the Richland, Hulings, and Spaulding; of raspberries, the Cumberland, Philadelphia (purple-cane) and the Orange (a hybrid of *Rubus Idæus* and a native American species, originated by Dr. Brincklé); of blackberries, the Allen and Erie are most important; of strawberries, Brandywine, Cumberland, Glen Mary and Sharpless; of peaches, the Globe, Klondike, and Tippecanoe; of cherries, the Ida; of chestnuts, the Paragon, Bartram, Miller, Numbo, Corson, Comfort, and Styer; of Persian walnuts, the Rush.

The opportunities for commercial vegetable-production are especially good in Pennsylvania because of its unusual number of good-sized cities and towns, in which the people are chiefly engaged in manufacturing or other industrial pursuits. In fact Pennsylvania contains fifty-eight cities of more than 10,000 inhabitants, which is seven more than any other state. This has developed large local production of vegetables around these cities in all parts of the state. In addition, there are considerable areas producing cabbage and other vegetables for shipment,—notably in Lancaster, York and Erie counties.

Another vegetable area of very intensive production has been developed on the muck soils around Wellsboro in Tioga County. In this place a total of about 280 to 300 acres of regular mucklands are in active service, besides some of the more fertile adjacent loams, which have sufficient fiber to produce good crops for a few years in favorable seasons. The annual production is estimated to bring in to the growers from \$125,000 to \$150,000, depending on season and prices. Celery and head lettuce are the only crops produced to any extent, and only one variety of each is used,—the Golden Self-blanching celery and the Big Boston lettuce. The former constitutes about 70 per cent of the crop. The crop is marketed in carlots, all of the lettuce and most of the celery going to Philadelphia.

Some of the leading varieties of vegetables that have apparently originated in Pennsylvania are as follows: bean, Burpee Bush Lima,—the fore-runner of all the large-podded bush limas, which was found as a chance variation in a field of Large White limas on the farm of Asa Palmer near Kennett Square, in 1883; celery,

Fordhook Emperor; beet, Burpee Extra Early, Bastian Extra Early Turnip, and Bastian Half-long Turnip; cabbage, Burpee Surehead and Houser. The latter is said to be the result of a cross between Flat Dutch and Fottler Brunswick. It was developed by George Houser about 1890 and introduced by the Holmes Seed Company in 1900; tomato, Chalk Jewel and Bonny Best. The former is the result of a cross between Hubbard Curled Leaf and Livingston Perfection, made by James Chalk of Norristown, in 1889. Bonny Best is said to be a selection of Chalk Jewel and was introduced by W. P. Stokes, in 1908.

The floricultural and special-crop interests have been developed to an unusual extent in the general vicinity of Pennsylvania. Some fifteen or twenty years ago, the carnation industry had developed to such an extent, especially around Kennett Square, that it had become known as the "carnation belt." There was also an unusual development of mushroom-production in the same district. Both industries then dropped back very materially for a time, but in the last few years the production of carnations, and especially of sweet peas, has come in again. The special carnation area has also extended and is now being developed to a large extent north of Philadelphia as far out as Hatboro, and even up to Lancaster. The latter city is becoming a carnation center, and is also producing considerable quantities of sweet peas, of which the leading varieties in this general section are of the Spencer class.

All the large growers in and around Philadelphia are also engaged in rose-production with a few fairly large places that are specializing in them. The American Beauty is the leading variety, especially in the Chestnut Hill district, which has the reputation of producing this rose in the highest state of perfection. The state as a whole, is credited with 1,331 floricultural establishments in 1909 with a value of \$3,803,000. It was excelled only by New York in this respect.

The nursery and seed interests around Philadelphia are also noteworthy. The seed-farms of Burpee & Company near Doylestown, and of the D. Landreth Seed Company near Bristol are among the largest in the country,—the former involving about 450 acres and the latter about 600 acres. The latter seed-house was established in Philadelphia in 1784. In nurseries, for both fruit and ornamental stock, there is now a total of more than 2,600 acres within a few miles of Philadelphia,—in Chester, Bucks, Montgomery, and Philadelphia counties,—which makes this one of the leading centers of the country for these industries.

In parks and city improvement systems, Pennsylvania is showing an unusual degree of interest. The oldest and largest rural park in the state is Fairmount in Philadelphia, which now has 3,448 acres and is being extended annually, part of it at great cost. It now includes the old Bartram Garden, established in 1728, the first attempt in the United States to gather trees for study purposes. The Centennial Exposition of 1876 was located in this park. Other smaller areas are annually being acquired for rural or community parks in various sections of the city. Pittsburgh has two rural parks, Schenley and Highland, and also the Alleghany Parks formerly known as the Commons. Especially notable park and civic improvements have been made in Harrisburg since 1902. The parking of the Susquehanna River front, the flood-prevention, extension of Reservoir Hill Park, establishment of playgrounds under supervision, the extension of Capitol Park, and the city control of shade trees are worthy of emulation by larger cities.

Among those now deceased who have rendered important service in one or more phases of horticulture, the following may be mentioned: John Bartram (volume III, page 1564), the founder of the Bartram Garden; John Adlum (page 1563), a native of York County, who first called special attention to the Catawba grape;

William D. Brincklé (page 1566), of Philadelphia, the second president of the American Pomological Society, experimenter with raspberries, strawberries, and pears, originator of the Orange raspberry in 1843, which is even yet the quality ideal in this fruit; Henry A. Dreer (page 1573), one of the pioneer seedsmen and nurserymen especially along ornamental lines; Thomas Meehan (page 1587), nurseryman and extensive writer along floricultural and landscape lines; W. G. Waring, nurseryman, fruit-grower, friend of Downing, and one of the first teachers of general horticulture in the College; Wm. A. Buckhout, and G. C. Butz (page 1568), botanists and horticulturists, long connected with the teaching staff of the College and state; and Gabriel Hiester (page 1580), fruit-grower, horticultural writer, long-time president of the State Horticultural Association.

Public-service agencies for horticulture.

The land-grant college of the state was opened for students in February, 1859, under the name of the "Farmers' High-School." This name was changed to "The Agricultural College of Pennsylvania" in May, 1862, and this again was changed to "The Pennsylvania State College" in 1874. It was accepted by the state as the land-grant college in 1863. There are now (in 1915) eleven men on the horticultural staff.

The Experiment Station is located at the College, and, including the Institute of Animal Nutrition, it involves a staff of eighty-eight persons. Thirty bulletins on horticultural subjects have been published by the Station, and twenty-one by the State Department of Agriculture, located at Harrisburg.

The School of Horticulture for Women at Ambler has a total of 90 acres of land, 20 acres being reserved for horticultural work. There are some thirteen agricultural high-schools in the state, giving more or less instruction in horticulture.

Some horticultural work, especially along the line of spraying and pruning demonstrations in connection with pest control, has been done for the past five or six years by the State Department of Agriculture at Harrisburg. The nursery inspection for the state is also done there, while the plant-disease work is in charge of the College. Definite inspection of the grading of fruit has not been provided for as yet.

A considerable amount of extension work in horticulture is done by the College staff, working especially through the state and county horticultural organizations. The experimental orchards of apples and peaches maintained by the College in the various fruit-growing sections of the state may also be considered as an important part of the extension work in the state.

Other associations devoted to horticultural interests are the State Horticultural Association of Pennsylvania, the Pennsylvania Horticultural Society (devoted chiefly to floricultural interests) and Pennsylvania Nurserymen's Association.

Statistics (Thirteenth Census).

The approximate land-area in 1910 was 28,692,480 acres. The land in farms was 64.8 per cent of the land area or 18,586,832 acres. Of this land in farms, the improved land numbered 12,673,519 acres; the woodland 4,281,439 acres; and other unimproved land in farms 1,631,874 acres. The number of all the farms in the state was 219,295, and the average acreage a farm 81.8. [The total area of Pennsylvania is 45,126 square miles.]

The leading agricultural crops of Pennsylvania are cereals, hay and forage, and tobacco. The acreage devoted to cereals decreased from 4,738,195 in 1899 to 4,324,058 in 1909, when the production was valued at \$70,348,726, which was 42.2 per cent of the total value of all crops. Hay and forage decreased in acreage from 3,269,441 in 1899 to 3,088,105 in 1909, when the pro-

duction was valued at \$45,623,573, which was 27.4 per cent of the total value of all crops. Tobacco increased in acreage from 27,760 in 1899 to 41,742 in 1909, when the production was valued at \$3,926,116. The value of the forest products of the farms was \$7,986,599 in 1909, as compared with \$6,481,181 in 1899.

Horticultural crops raised in Pennsylvania are fruits and nuts, small-fruits, potatoes and other vegetables and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$9,619,156, as compared with \$8,707,131 in 1899. Small-fruits decreased in acreage from 12,271 in 1899 to 8,678 in 1909, when the production was 13,620,047 quarts, valued at \$1,175,016. The total acreage of potatoes and other vegetables in 1909 was 357,430 acres and their value \$22,092,197. Excluding potatoes, the acreage of the other vegetables increased from 79,126 in 1899 to 94,111 in 1909, when the production was valued at \$10,013,920. The acreage devoted to the production of flowers and plants and nursery products increased from 4,274 in 1899 to 4,860 in 1909, when the production was valued at \$4,725,987.

The production of all orchard-fruits in 1909 was 13,285,953 bushels, valued at \$8,677,986. The production of apples, the most important of the orchard-fruits, was, in 1909, 11,048,430 bushels, valued at \$5,557,616. The number of apple trees of bearing age in 1910 was 8,000,456; those not of bearing age, 2,501,185. The number of peach and nectarine trees of bearing age, in 1910 was 2,383,027; those not of bearing age, 2,179,386. The production in 1909 was 1,023,570 bushels, valued at \$1,351,175. The other orchard-fruits produced were 378,825 bushels of pears, valued at \$356,210; 295,158 bushels of plums and prunes, valued at \$396,005; 475,093 bushels of cherries, valued at \$909,975; 62,350 bushels of quinces, valued at \$102,431; and 2,502 bushels of apricots, valued at \$1,497.

The production of grapes in 1909 was 31,020,198 pounds, valued at \$850,708. The grape-vines of bearing age in 1910 numbered 5,271,264; those not of bearing age, 8,252,811.

The total production of nuts in 1909 was 3,795,804 pounds, valued at \$90,447. The individual production of the various nuts was: 2,162,471 pounds of black walnuts, valued at \$39,306; 593,200 pounds of hickory-nuts, valued at \$25,348; 233,834 pounds of chestnuts, valued at \$15,185; 782,415 pounds of butternuts, valued at \$9,408; 14,885 pounds of pecans, valued at \$532; and 4,523 pounds of Persian or English walnuts, valued at \$516.

Strawberries are the most important of the small-fruits grown in Pennsylvania, with raspberries and loganberries second in importance. The acreage of strawberries decreased from 5,667 in 1899 to 4,136 in 1909, when the production was 9,033,904 quarts, valued at \$759,154. Raspberries and loganberries decreased in acreage from 3,938 in 1899 to 2,594 in 1909, when the production was 2,906,302 quarts, valued at \$272,337. Blackberries and dewberries decreased in acreage from 1,383 in 1899 to 1,235 in 1909, when the production was 1,063,257 quarts, valued at \$91,007. Other small-fruits produced were: 493,871 quarts of currants, valued at \$42,181; 109,104 quarts of gooseberries, valued at \$9,047; and 5,728 quarts of cranberries, valued at \$503.

The acreage of potatoes in Pennsylvania increased from 227,867 in 1899 to 262,013 in 1909, when the production was 21,740,611 bushels, valued at \$11,973,843. The more important of the other vegetables produced in 1909 were: 11,764 acres of sweet corn, valued at \$507,736; 5,679 acres of cabbage, valued at \$502,969; 4,204 acres of tomatoes, valued at \$412,519; 1,096 acres of celery, valued at \$254,693; 1,191 acres of asparagus, valued at \$174,965; 551 acres of onions, valued at \$107,307; and 1,752 acres of turnips, valued at \$86,079. Vegetables the production of which was

valued between \$10,000 and \$50,000 were green beans, beets, cantaloupes and muskmelons, carrots, cucumbers, horse-radish, lettuce, green peas, radishes, rhubarb, spinach, and watermelons. Vegetable products, the production of which was valued at less than \$10,000, were cauliflower, pop-corn, eggplant, kale, parsley, parsnips, green peppers, pumpkins, rutabagas and squash.

Flowers and plants increased in acreage from 1,073 in 1899 to 2,032 in 1909. The area under glass in 1909 was 13,846,672 square feet, of which 12,887,672 were covered by greenhouses, and 959,000 by sashes and frames. The value of the flowers and plants produced in 1909 was \$3,803,418, as compared with \$2,246,075 in 1899.

The acreage devoted to nursery products decreased from 3,201 in 1899 to 2,828 in 1909, when the value of the nursery products produced was \$922,569, as compared with \$541,032 in 1899. The production of flower and vegetable seeds was valued at \$36,316 in 1909, as compared with \$104,229 in 1899.

JOHN P. STEWART.

EAST NORTH CENTRAL STATES.

Ohio.

Ohio (Fig. 2496) is essentially an agricultural state. This is not because the soil and climate are not adapted to the production of horticultural products, but rather for the reason that in early days the markets for fruit and vegetables were limited. With the growth of cities and the opening of markets in other states and countries, there has been a steady increase in the production of most kinds of horticultural products which are adapted to the climate.

The climate is well suited to fruit-culture except in an occasional season. Even in such cases, losses by extreme cold may usually be avoided by proper selection of site. There are only limited areas where the soils are unadapted either to fruits or vegetables. There are many soils which are found to be well adapted to specialized crop-production. The annual rainfall is about 38 inches and crop failures because of severe drought seldom occur.

The influence of Lake Erie, on the north, is very marked upon fruit-culture in general. In that region, peach buds are seldom killed in winter, while both early and late frosts seldom harm early blossoms or late-ripening fruits. Fruit-production for this reason has been greatly stimulated in that region. Convenience to markets has been a potent factor also. The soil in the lake region varies from a sandy to heavy clay, thus making it possible to grow all of the fruits which thrive within the state. More back-to-the-land fruit-growers are found in this region than in any other part of the state. The larger number, however, are men of considerable practical experience, most of whom are successful along special lines of fruit-culture.

The hill lands in the southern and eastern parts of the state constitute another distinct division suitable for most kinds of fruits. The special virtue of these lands is that they give high color, good flavor and excellent keeping quality to apples, peaches and pears. This is particularly true of the greatest elevations. Comparative freedom from frost is another virtue of the hill lands. In many cases, however, the soil on the hills is much worn and lacking in humus. The success of the Experiment Station in the use of commercial fertilizer on apple orchards in this region has stimulated apple-growers to practise better methods. Many orchards have been brought back from low crop-production to a very satisfactory condition of fruitfulness. The restoration of humus has not kept pace with fertilizing, but without doubt this important feature of orchard rejuvenation will not be neglected much longer.

On the whole, Ohio compares favorably with other states as to horticultural possibilities, but not as to development. However, there have been marked increases in crop-production within recent years of apples, peaches, cherries, potatoes, onions, celery, tomatoes, greenhouse vegetables and canning crops. There has been some falling off in grapes and berries, but enough are still produced for the local markets.

Increased interest in horticultural work is manifest along many lines but the greatest is in apple-culture. Old orchards are decaying rapidly but many new ones have been planted and the best of the old ones rejuvenated. The apples have been greatly improved in quality by proper care of the trees. This is plainly shown by the rapidly improving excellence of the apple shows, both as to quality and quantity of fruit displayed. The stimulus of the shows seems to have been more to improve the quality than to increase the quantity, and yet many orchards have been planted recently. Many of these are of considerable size; 50- and 100-acre orchards are becoming quite common. It does not appear, however, that overplanting has been done as the standard of excellence is maintained. The greater part of the planting is in the eastern and southeastern part of the state. Nearly all of the orchards planted are for commercial purposes. Home orchards are decaying more rapidly than new ones are being planted.

It cannot be said that there are any well-defined apple-belts within the state. Apple orcharding is usually carried on with general farming or with some other line of fruit-growing. Mature apple orchards are not usually cultivated in the hilly part of the state. Mulching is often practised where material can be secured. Young orchards are usually cultivated for a few years, but orchards set in grass and well mulched are not uncommon.

Rome Beauty is the general favorite for market in the southern part of the state and Baldwin takes the same place in the northern part, although it is not planted so exclusively as the Rome Beauty. Ben Davis has been a favorite in all sections but its popularity is waning, although it is still retained by many growers in the southern counties. There are no other varieties so extremely sectional as those named, although Rhode Island Greening and Northern Spy are nearly so in the north, and Willow Twig in the eastern part of the state.

Peaches are not grown to any extent commercially except along the southern shore of Lake Erie. Peach orchards have nearly supplanted vineyards in the lake counties. Partial or full crops are often produced in the central and southern part of the state, and these have the effect of keeping the industry alive, although less flourishing in Athens, Muskingum and Coshocton counties than formerly. Better cultural conditions and more care in protecting against peach-tree enemies are given peach orchards in the lake region than elsewhere in the state. Ottawa is the best peach county of the state in sureness of crop, care given and crop-production.

Pears are not extensively grown in any part of Ohio, the Kieffer being planted more than any other variety. This variety has recently shown such susceptibility to blight that it is now regarded as a menace to pear- and apple-culture. The destruction of Kieffer pear trees is regarded by some as a necessary step in orchard sanitation.

American and Japanese plums are discarded by plum-

growers and but few remain to mark an erratic and unprofitable venture. No varieties but European are now planted, but the attention given to plum-culture within the state is limited.

The culture of cherries is confined almost wholly to sour varieties. The center of this industry is at Clyde, but small orchards are found in most parts of the state.

Grape-culture along the lake shore east of Cleveland has fallen off considerably in recent years because of the encroachment of the city and failure of the growers to control the berry moth. Prices also have been unsatisfactory. The manufacture of unfermented grape-juice, which has assumed considerable proportions, has helped to improve prices somewhat on the islands, but has not stimulated planting to any extent.

Small-fruits of all kinds are grown in sufficient quantities for the home markets, by local growers, but few



shipments are made to points outside the state. There are no small-fruit belts within the state, although more are grown in the northern part than elsewhere.

There is much interest in Persian walnuts and pecans at present, and plans have been considered of starting orchards of these nut-bearing trees. Along Lake Erie and the Ohio River, a few trees are known to be producing fruit. Thus far both of these species appear to be tender in winter. Persian walnut trees, except along the lake shore, almost always die back to the ground in winter. Pecans are more hardy, and early ripening varieties may prove satisfactory. But little effort has been made, however, to use grafted trees, especially in the case of Persian walnuts, thus courting failure. No orchards are known to have been planted of these nut-trees, and the same is true of other nut-bearing trees.

Market-garden crops, including potatoes, bring greater returns than the fruit crops. Potato-culture has assumed considerable proportions in Portage, Stark, Summit, Cuyahoga and Wayne counties, follow-

ing closely what is termed the "wheat belt." Hamilton produces more early potatoes than any other county.

Celery and onions are grown largely on mucklands in Hardin, Huron, Medina, Wayne, Cuyahoga, Stark and Ashtabula counties. It has been found possible to sub-irrigate some of these muck farms, making crop production more sure.

Tomatoes are grown in various parts of the state, in large quantities for canning factories. In the south-eastern part of the state, near Marietta, several hundred acres are devoted to growing early tomatoes. Staking the plants is the universal practice, as it is conducive to early maturity.

Early cabbage is grown in the same locality and at various other points along the Ohio River. Late cabbage, for krout, is an important crop in Sandusky and Seneca counties.

Several thousand acres, in various parts of the state, are devoted to cucumbers for pickling establishments. Canneries use sweet corn, tomatoes and peas almost exclusively, except peaches in the peach-belt.

Vegetable-culture under glass has assumed very large proportions at Ashtabula, Cleveland, Columbus, Newark and Toledo, but vegetable houses of considerable size are found in all parts of the state. Grand Rapids lettuce, tomatoes and cucumbers are the principal crops grown.

There are about 300 acres under glass within the state devoted to vegetable-culture, with an investment of \$6,000,000. One house in Toledo covering 10 acres, is said to be the largest in the world devoted to vegetable-culture. Vegetable-forcing about Cincinnati has been conducted mostly in hotbeds and coldframes, but greenhouses are now taking the place of beds. The greatest development of this industry is at Ashtabula, Toledo, Cleveland, Columbus, Newark, and Barberton. Small houses are also found in many towns. The usual custom is to change the soil in vegetable houses at frequent intervals. Soil-sterilization by steaming is practised, and manure or some fresh compost added each year. It has been found that mulching the soil with coarse manures as soon as the spring crops are off, and watering frequently, answers essentially the same purpose as sterilization. Beds have been kept in good condition eight years by this method.

Floral establishments are found in nearly every city and town. The larger number of these are for cut-flowers but a few do a mail order business and others grow pot and bedding plants.

The nursery business is very large and supplies more trees than are needed within the state, possibly apple trees excepted. A large increase in ornamental stock is reported, and there is evident improvement in methods of planting home grounds.

Among those influential in the early development of Ohio horticulture are: J. P. Kirtland (Volume III, page 1582); J. A. Warder (page 1602), with whom were closely associated Nicholas Longworth (page 1585), A. H. Ernst (page 1574), S. S. Jackson and A. H. Hoopes; George W. Campbell (page 1568); M. B. Betcham; F. R. Elliott (page 1574); Nelson Cox, who demonstrated the feasibility of apple-culture on the hill lands of the state; A. W. Livingston, who greatly improved the tomato and N. Olmer.

Public-service agencies for horticulture.

The College of Agriculture of Ohio is located at Columbus. There are six teaching members of the horticultural staff.

The Experiment Station is at Wooster. Much experimental work is in progress at three branch stations, or test farms, belonging to the station, and six county farms under station control.

The Bureau of Nursery and Orchard Inspection at Columbus has charge of the inspection work.

The first horticultural organization was the Ohio

Pomological Society in 1847. The name was afterward changed to the Ohio State Horticultural Society.

Statistics (Thirteenth Census).

The approximate land area of Ohio in 1910 was 26,073,600 acres. The land in farms was 92.5 per cent of the land area, or 24,105,708 acres. Of this land in farms, the improved farm land numbered 19,227,969 acres; the woodland 3,285,376 acres; and other unimproved land in farms 1,592,363 acres. The total number of farms in 1910 was 272,045, and the average acreage 88.6 acres. [The total area of the state is 41,040 square miles.]

The leading agricultural crops of Ohio are cereals, hay and forage, tobacco, and forest products of farms. The acreage devoted to cereals decreased from 8,214,960 in 1899 to 7,619,873 in 1909, when the production was valued at \$137,907,934, which was 59.9 per cent of the total value of all crops of the state. The acreage of hay and forage was 3,015,261 in 1899 and 3,306,461 in 1909, when the production was valued at \$42,357,364. Tobacco increased in acreage from 71,422 in 1899 to 106,477 in 1909, when the product was valued at \$8,998,887. Forest products of farms in 1909 were valued at \$5,761,941, as compared with \$5,625,897 in 1899.

Horticultural crops produced in Ohio are fruits and nuts, small-fruits, potatoes and vegetables, and flowers, plants, and nursery products. In 1909 the value of the fruits and nuts produced was \$6,561,861, as compared with \$7,138,734 in 1899. Small-fruits decreased in acreage from 21,121 in 1899 to 11,591 in 1909, when the production was 15,721,023 quarts, valued at \$1,296,343. In 1909 the total acreage of potatoes and other vegetables was 337,412, and their value \$20,875,927. Excluding potatoes, the acreage of the other vegetables increased from 103,316 in 1899 to 123,461 in 1909, when the production was valued at \$11,393,791. The raising of flowers and plants and nursery products is of considerable importance, the acreage having increased from 5,384 in 1899 to 5,788 in 1909, when the production was valued at \$3,245,181.

The total production of orchard-fruits produced in 1909 was 6,711,208 bushels, valued at \$5,691,530. Apples contributed about two-thirds of this quantity, and peaches and nectarines most of the remainder. The number of apple trees of bearing age in 1910 was 8,504,886; those not of bearing age 2,438,436. The production in 1909 was 4,663,752 bushels, valued at \$2,970,851. The number of peach and nectarine trees of bearing age in 1910 was 3,133,368; those not of bearing age, 2,092,300. The production in 1909 was 1,036,340 bushels, valued at \$1,349,311. The production of other orchard-fruits was: pears, 374,871 bushels, valued at \$332,727; cherries, 338,644 bushels, valued at \$657,406; 215,657 bushels of plums and prunes, valued at \$278,505; 81,101 bushels of quinces, valued at \$101,369; and 835 bushels of apricots, valued at \$1,343.

The production of grapes in 1909 was 43,933,207 pounds, valued at \$858,594. The vines of bearing age in 1910 numbered 8,326,800; not of bearing age, 455,750.

The production of nuts in 1909 was 559,093 pounds, valued at \$11,691. This production consisted of 354,135 pounds of black walnuts, valued at \$4,645; 135,626 pounds of hickory-nuts, valued at \$3,856; 36,091 pounds of chestnuts, valued at \$2,584; 29,100 pounds of butternuts, valued at \$360; 2,461 pounds of Persian or English walnuts, valued at \$154; and 1,010 pounds of pecans, valued at \$70.

Strawberries are by far the most important of the small-fruits, with raspberries and loganberries, and blackberries and dewberries second and third respectively. The acreage of strawberries decreased from 9,373 in 1899 to 4,706 in 1909, when the production was 8,501,065 quarts, valued at \$677,767. Raspberries and loganberries decreased in acreage from 6,795 in 1899 to 3,869 in 1909, when the production was 4,029,480 quarts, valued at \$361,272. The acreage of

blackberries and dewberries decreased from 3,397 in 1899 to 2425 in 1909, when the production was 2,465,407 quarts, valued at \$195,294. Other small-fruits produced in 1909 were: 460,575 quarts of currants, valued at \$39,829; 255,840 quarts of gooseberries, valued at \$18,404; and 4,256 quarts of cranberries, valued at \$352.

The acreage devoted to the production of potatoes in Ohio increased from 167,590 in 1899 to 212,808 in 1909, when the production was 20,322,984 bushels, valued at \$9,377,955. Of the other vegetables, the more important in 1909 were 6,132 acres of onions, valued at \$858,440; 17,298 acres of sweet corn, valued at \$528,162; 8,263 acres of tomatoes, valued at \$501,020; 6,279 acres of cabbage, valued at \$366,901; 1,473 acres of celery, valued at \$331,230; and 1,665 acres of cantaloupes and muskmelons, valued at \$154,434. The value of other vegetables produced was as follows: asparagus, \$39,391; green beans, \$39,352; pop-corn, \$16,878; cucumbers, \$113,238; lettuce, \$76,372; green peas, \$69,009; radishes, \$15,194; rhubarb, \$11,329; turnips, \$31,791; and watermelons, \$46,063. Vegetables produced, valued at less than \$10,000, were beets, carrots, cauliflower, horse-radish, parsnips, green peppers, pumpkins, spinach, and squash.

The acreage devoted to the production of flowers and plants increased from 685 in 1899 to 1,070 in 1909. The area under glass in 1909 was 7,582,562 square feet, of which 7,091,976 were covered by greenhouses, and 490,586 by sashes and frames. The value of the flowers and plants produced in 1909 was \$2,384,830.

There was a slight increase in the acreage devoted to nursery products—from 4,699 in 1899 to 4,718 in 1909, when they were valued at \$860,351, as compared with \$538,012 in 1899.

W. J. GREEN.

Indiana.

Indiana (Fig. 2497), classed among the North Central States, has a land area of 23,068,800 acres. The greater part of the state is gently undulating, yet much of the highest land in the central counties is very level. The mean elevation of the state is estimated at 700 feet above sea-level. The highest lands are above 1,000 feet and are found along the Ohio line in east-central Indiana and near the Michigan line in extreme north-eastern Indiana. The area in which the altitude is from 500 to 1,000 feet constitutes four-fifths of the entire state. The lowest elevation within the state is found in the western and southwestern counties along the Wabash River, where the land surface rises in general to an altitude of less than 500 feet above sea-level.

The climate differs little from the northern or middle states of the Atlantic seaboard. The mean annual temperature for the state is 52.3°, and the average rainfall is 38.4 inches.

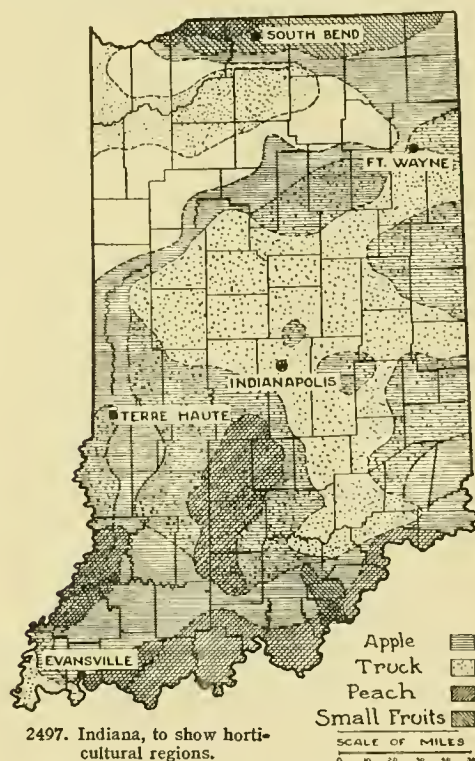
Indiana has never been looked upon as a fruit-growing state. This is due to a happy combination of circumstances and conditions which make Indiana preëminently an agricultural state. Corn has been "king" in Indiana and probably always will be. The soil and climate of the middle western states are especially adapted to the necessary food-crops. These crops have been produced in an abundance and have overshadowed the horticultural crops.

From the earliest years of the last century, when Johnny Appleseed made his plantings in the wilderness, it has been evident that the soil and climate of the state were adapted to fruit. Numerous of these early orchards can be identified at present and their fruits are often shown at the state apple shows. Henry Ward Beecher, writing from Indianapolis in 1843, says that at that time there were "eighteen nurseries in the state whose proprietors are chiefly supported by their sales. Apple trees sell for 10 and pear for 20 cents. An orchard is to be found upon almost every farm and

lately the pear has been made more than ever sought after. . . . Long summers, brilliantly clear atmosphere, great warmth and dryness during the fall ripening months, give our fruit great size, color and flavor."

The early horticulture was principally along the Ohio River and its smaller tributaries. Large plantings were made to apples and peaches. With the experiences of the Dufours ever before them, the early horticulturists paid very little attention to the grape. Nevertheless, several vineyards were planted on the terraced river bluffs only to fall easy victims to plant disease and insect pest. Some of the largest peach and plum orchards of the country were then to be found in Jefferson, Floyd, Clark, Harrison and Perry counties, in the southern part of the state. In fact, fruit-growing was the principal industry of the section.

At length there came a change in condition. The pear and apple orchards suffered from the fire blight.



2497. Indiana, to show horticultural regions.

The peach orchards were ravaged by the San José scale and the yellows. The codlin-moth and the curculio multiplied unchecked; the scab, the various rots and other fungous diseases reduced the crops in both quantity and quality and many of the once profitable orchards were practically abandoned except for an occasional year of excessive production. The fruit was then perhaps harvested, but, owing to its poor quality, found a slow sale on a heavily supplied market.

With the establishment of the experiment station in 1887 dates the present revival in horticulture. Control measures were developed for crop pests and disease. Large companies have been formed for speculation in fruit lands, for exploitation of orchard-renovation schemes or for straightforward business development of commercial fruit-growing.

Time has shown that the soil and climate of Indiana are adapted to all of the horticultural crops of its latitude. This certainty of production, coupled with the location of the state, make it a very attractive district for the production of perishable horticultural

crops. Indianapolis, the capital and center of the state, is within 50 miles of the center of population of the United States. It is the geographical center of the territory stretching from Maine to Colorado, which embraces 92½ per cent of the total population of the nation. A circle with a 300-mile radius, having Indianapolis as its center, includes over one-quarter of the population of the country.

Another factor of no little importance to the horticultural interests of the state is the low price of lands suited to the various horticultural crops. Excellent land for orchard and truck crops can be purchased from \$25 to \$50 an acre.

Many horticultural crops are now grown in Indiana, but the apple easily stands first. The state ranks seventh in the ten-year average production of this fruit, so far as quantity is concerned. The present apple-growing sections are found in the northern counties, the valleys of the Wabash, White-water, White and Ohio rivers and the south-central hill counties. Large commercial plantings are being made in these regions. In the northern sections, the Baldwin, Spy, and Greenings predominate. In the central and southern sections the new plantings are being made of Grimes, Rome, Wine-sap, Staynman, and Ben Davis. The early sorts are not being planted so extensively as the market seems to warrant. Several large plantations, however, have used Yellow Transparent, Wealthy, Duchess, and Wagener as fillers. The larger part of commercial orchards are well sprayed. The very abundance of pests makes this a necessity. Unsprayed trees in Indiana live in the shadow of a signed death warrant. The San José scale, blotch, bitter-rot and blight soon remove the unfit. These pests are the best friends of the commercial grower for they clear his markets of undesirable bulk stock. Lime-sulfur is generally used as a winter spray for San José scale and general sanati-cide. Bordeaux has been replaced in the northern sections by dilute lime-sulfur. In the central and southern regions, however, where blotch and bitter-rot are ever present, the old tried and true bordeaux is still used. Dry arsenate is almost universally accepted as the standard insecticide for chewing insects. The bulk of the Indiana apple crop is marketed in the barrel. The box is receiving attention in some sections but is not yet a common package. The fancy and choice grades are generally stored in commercial cold-storage rooms. The state is well equipped with storage facilities. Excellent houses are found in Indianapolis, Vincennes, Washington, Seymour, Martinsville, Terre Haute, Brazil, South Bend and Ft. Wayne.

The Indiana orchardist is now making the most of his long neglected opportunities. Old orchards are being leased and new ones planted on every side. Neglected orchards are being pruned, cultivated, sprayed, and fertilized as never before.

Indiana has given one hundred varieties of apples to the pomology of the country. The most important of these are: Banana, Clayton, Indian, Indiana Favorite, Pound Sweet, Ragan, Ronk, and Wilson. Other Indiana varieties are the Hoosier Cling peach, Wilder currant, Gregg raspberry, and the Taylor and Snyder blackberries.

The peach, plum, and cherry thrive in every part of the state and are always found in the home orchard. They are of commercial importance, however, only in exceptionally favored locations, along the southern shore of Lake Michigan, the lower Wabash Valley, the central hill counties, and the old Ohio Valley peach region. Orchards in these locations do remarkably well and the industry is being extended each year. Commercial peach plantings are largely limited to the Elberta. This variety does exceedingly well in the southern sections. Cherry orchards are planted only of Early Richmond and Montmorency. Plums are planted very little in a commercial way.

Small-fruit plantations are found around every city of importance. Sections of Floyd and Clark counties (southeastern part of Indiana) are devoted almost entirely to the production of early berries for northern markets. The fruit from this region strikes a free market and finds a very ready sale. The northern tier of counties also produce berries of high quality and at a time of free and brisk markets.

Several wild fruits and nuts grow to perfection in Indiana and have assumed commercial importance in some localities. The cranberry and blueberry are found in the muck, swampy soil regions, the persimmon and pawpaw in all parts of the state and the pecan in the southern river-bottoms.

The trucking interests are especially strong in Indiana. Thousands of acres along the Kankakee River are of a muck formation. When properly drained, this soil is excellent for the large number of vegetable crops.

Onions are the most important crop grown in this region. The land is drained by county ditches and intricate systems of tile drains. Large areas are generally held by one owner who leases the land to foreign labor. The Southport Globes, yellow and red, are almost exclusively grown. Yields of 800 to 900 bushels to the acre on this rich soil are not at all uncommon. Celery is also a favorite crop for this soil. Golden Self-blanching, Winter Queen, and Giant Pascal are grown for the Chicago market. Large areas of cabbage are planted mainly for the kraut factories. The varieties most generally grown are Flat Dutch, All Seasons, and similar sorts. Potatoes are grown for the early and late markets. The main planting is of the late varieties, generally Rural New Yorker. Large fields of peppermint are grown for the oil-stills. Excellent yields are secured and handsome profits made.

The central area or corn-belt is a large producer of the canning crops. Tomatoes and corn are the principal crops. The sandy soils of Knox (in the southwestern part of the state) and surrounding counties produce cantaloupes and watermelons which supply the markets of the country by train-loads. Sugar-beets are grown in several sections of the state but reach their highest state of excellence in Adams, Well, and Jay counties, in the eastern part of the state. The truck industry of Indiana is of great importance and is very diversified.

No sketch of the early history of Indiana horticulture, however fragmentary and incomplete, can omit the names of some of the pioneer horticulturists of the state. The names of the Ragans, of Teas, and Fletcher, and Warder, and a dozen of their fellows, will always be remembered in connection with the early founding, the rapid spread, and the abundant success of pioneer Indiana horticulture.

The nursery business in Indiana has kept pace with the ever-growing demand for horticultural stock. There are now 150 regularly inspected nurseries in the state. The largest cherry nursery in the country is located at Vincennes. Several nurseries catering only to the ornamental trade are found near Indianapolis. The larger number of firms, however, deal in general stock and cater especially to the general farm orchard.

Indiana floriculture is well developed and in a thriving condition. Large ranges of commercial houses are found around the more important cities, such as Ft. Wayne, South Bend, Indianapolis, Terre Haute, and Evansville. These ranges are devoted primarily to the wholesale and retail trade. The plant-breeder and introducer seems to favor the smaller towns. Some of the most important varieties of roses, carnations, and chrysanthemums have been produced in small Indiana plants. The Newcastle roses are justly famous the world over. The Sunburst and Ophelia roses, as well as many others, were produced at Richmond. One of the largest breeders and introducers of carnations in the United States is located at LaFayette.

Public-service agencies for horticulture.

Early in 1865, the State Legislature obligated the state to "accept and claim the benefits of the provisions of the Acts of Congress, approved July 2, 1862, and April 4, 1864," which provided for the land-grant colleges. The state further accepted donations from John Purdue and other citizens of Tippecanoe County, and in 1869 the Legislature located the University at Lafayette. This same act provided that the institution be called "Purdue University." While named after a private individual, the University is, however, a land-grant college and is exclusively under state control. The work of this institution is divided into three district divisions: The Collegiate Departments; Agricultural Experiment Station; and Agricultural Extension Department. There are thirteen members of the horticultural staff. Forty-two bulletins have been issued from the horticultural department.

Several of the secondary colleges of the state are offering either special work in horticulture or courses in applied botany. The most complete course of this kind is that offered by Winona Agricultural College. Under a legislative act of 1911, the teaching of agriculture became compulsory in the rural schools. Special courses in fruit-growing and vegetable-gardening have been outlined and published for the seventh and eighth grades and for high-schools. This rural school work is closely supervised either by the special county agricultural agents or special agricultural supervisors.

The state maintains a special department for the enforcement of horticultural laws. This division is headed by the State Entomologist. His main duty is that of guarding against the introduction and spread of noxious insects and plant diseases.

The Horticultural Society is one of the most important public-service agencies for horticulture in Indiana. It was founded in 1860.

Statistics (Thirteenth Census).

The approximate land area of Indiana, according to the Census Report of 1910, is 23,068,800 acres. The land in farms is 92.3 per cent of the land area, or 21,299,823 acres. The number of acres of improved land in farms is 16,931,252; that of woodland 3,370,791, and other unimproved land in farms numbers 997,780 acres. The number of all the farms in the state, in 1910, was 215,485. The average acreage to a farm was 98.8. [The total area is 36,354 square miles.]

The leading agricultural crops of the state are cereals and hay and forage. In 1909, the cereals contributed about three-fourths, or 74.1 per cent of the total value of all crops, and hay and forage about one-eighth, or 12.2 per cent. Of the improved land in the state in 1909, 51.7 per cent, or 8,752,732 acres were occupied by cereals, the products of which amounted to \$151,898,146. The acreage of hay and forage in 1909 was 2,300,579, and the value of the products, \$24,883,461. The acreage devoted to tobacco in Indiana increased from 8,219, in 1899, to 23,691 in 1909, when the value of the products was \$2,145,193. The value of the forest products of the farms of Indiana, in 1909, was \$5,603,322, about the same as in 1899, when it was \$5,235,459.

Horticultural crops grown are fruits and nuts; small-fruits; vegetables, including potatoes, sweet potatoes and yams; and flowers and plants and nursery products. The total value of fruits and nuts grown in 1909 was \$4,004,367, as compared with \$3,522,896, their value in 1899. The acreage devoted to raising small-fruits decreased from 13,115 acres, in 1899, to 5,919 acres in 1909, when 7,424,831 quarts of fruit were produced, valued at \$612,725. In 1909, the total acreage of potatoes and other vegetables was 215,332, and their value, \$11,454,036. Excluding potatoes, and sweet potatoes and yams, the acreage of the other vegetables was 114,267, and their value, \$7,498,024, as compared

with an acreage of 95,434 in 1899, when the value of their products was \$4,524,435. The acreage devoted to the growing of flowers and plants and nursery products increased from 1,820 acres, in 1899, to 2,346 in 1909, when the products were valued at \$1,624,278.

The total quantity of orchard-fruits produced in 1909 was 4,713,537 bushels, valued at \$3,709,275. Apples contributed more than half of this quantity, with peaches and nectarines next in importance. The production of apples alone, in 1909, was 2,759,134 bushels, valued at \$1,720,811; that of peaches and nectarines, 1,174,389 bushels, valued at \$1,123,248; that of cherries, 363,993 bushels, valued at \$508,516; and that of pears, 319,925 bushels, valued at \$243,698. Plums and prunes were produced to the value of \$89,073; quinces, to the value of \$22,431; apricots, to the value of \$1,472; and mulberries, to the value of \$26.

The grape-vines of bearing age in 1910 were 1,049,232, and those not of bearing age, 149,441. The production in 1909 was 12,817,353 pounds, valued at \$287,707.

The total production of nuts in 1909 was 439,644 pounds, valued at \$7,344. Black walnuts are by far the most important of the nuts grown in Indiana. In 1909 the production of black walnuts was 378,842 pounds, valued at \$4,386; that of pecans, 19,287 pounds, valued at \$1,940; and that of hickory-nuts, 31,950 pounds, valued at \$753.

The total acreage of small-fruits in 1909 was 5,919, and in 1899, 13,115, a decrease of 54.9 per cent. The production in 1909 was 7,424,831 quarts, as compared with 22,088,000 quarts in 1899, and the value, \$612,725, as compared with \$1,113,527. Strawberries are by far the most important of the small-fruits, with raspberries and loganberries, and blackberries and dewberries ranking second and third respectively. The acreage of strawberries decreased from 4,714, in 1899, to 2,574 in 1909, when the production was 3,759,132 quarts, valued at \$310,430. The acreage of raspberries and loganberries decreased from 3,277, in 1899, to 1,412 in 1909, when the production was 1,595,921 quarts, valued at \$140,204; and the acreage of blackberries and dewberries decreased from 3,192, in 1899, to 1,347 in 1909, when the production was 1,482,909 quarts, valued at \$113,322. Other small-fruits produced in 1909 were 320,963 quarts of gooseberries, valued at \$25,682; 208,019 quarts of currants, valued at \$16,901; and 7,552 quarts of cranberries, valued at \$498.

Of the vegetables grown in Indiana, the potato is by far the most important. In 1909, the acreage devoted to the potato was 99,504, and the production was 8,905,679 bushels, valued at \$3,816,126. The leading vegetables grown in 1909, their acreage and value of products were: tomatoes, 18,472 acres, value of product, \$501,180; onions, 4,048 acres, valued at \$488,811; watermelons, 7,915 acres, valued at \$291,027; cantaloupes and muskmelons, 3,855 acres, valued at \$198,531; sweet corn, 7,977 acres, valued at \$188,054; sweet potatoes and yams, 1,561 acres, valued at \$139,886; cabbage, 2,107 acres, valued at \$126,052; cucumbers, 2,095 acres, valued at \$111,268; and green peas, 4,084 acres, valued at \$103,613. Vegetables of less importance grown were asparagus, beans, celery, pop-corn, lettuce, radishes, rhubarb, and turnips.

The growing of flowers and plants is of some importance in Indiana, the acreage increasing from 174 acres, in 1899, to 496 acres in 1909, an increase of 185.1 per cent. The area of land under glass, in 1909, was 3,741,269 square feet, of which 3,650,143 square feet were covered by greenhouses and 90,826 square feet by sashes and frames. The value of the flowers and plants, in 1909, was \$1,212,891, as compared with \$400,730, in 1899, an increase of 202.7 per cent.

The acreage devoted to the growing of nursery products increased from 1,646 acres, in 1899, to 1,850 acres in 1909, an increase of 12.4 per cent. The value of the nursery products sold in 1909 was \$411,387, as

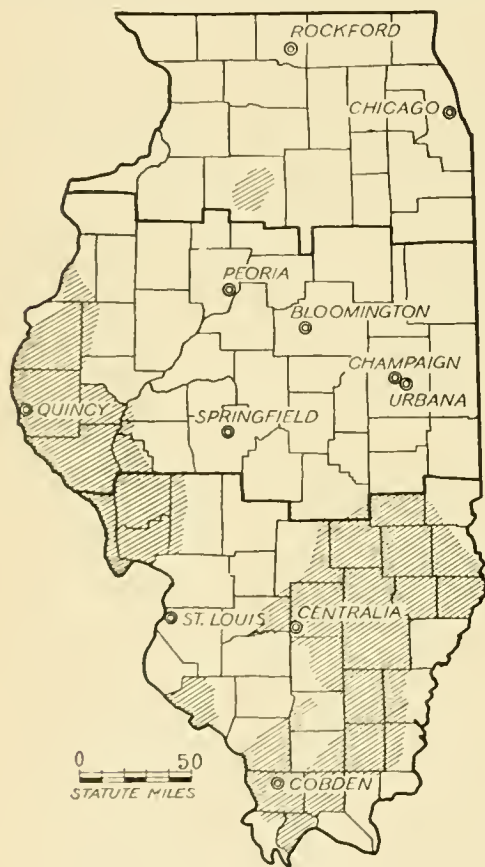
compared with \$254,893 in 1899, an increase of 61.4 per cent.

M. W. RICHARDS.

Illinois.

The state of Illinois (Fig. 2498) lies in the heart of the Mississippi Valley, the most fertile portion of the United States. Its eastern boundary is over 700 miles from the Atlantic coast; it has a range north and south of a little over 350 miles, extending from 37° to 42° 30' north latitude, and a breadth east and west of about 200 miles at its widest point. In spite of its great length, the difference in mean annual temperature between the extreme northern and southern parts of the state is only 10° F.

Soil conditions alone considered, Illinois stands, agriculturally, at the very forefront. It is known as the great prairie state, and with the exception of Delaware and Louisiana, is the most level state in the Union.



2498. Illinois.—The main horticultural areas.

Third in population (1910), and second in railroad mileage, it is first in total value of agricultural products. Over nine-tenths of its total area is in farms. There are no considerable tracts of worthless land, and the statistics of the United States Census for 1910 show every one of the 102 counties to be fruit-producing.

The most distinctive fruit section of Illinois is the southern third. This area contains something over 150,000 acres devoted to the growing of apples alone. Other deciduous fruits, notably peaches and pears, and small-fruits, especially strawberries, are also grown in large quantities in this part of Illinois. Increased shipping facilities and the coming into bearing of orchards already some time planted have brought southern

Illinois into close competition with Michigan in the production of peaches.

The southern fruit district, as indicated on the map, lies between 37° and 39° 30' north latitude, the former being the latitude of Norfolk, Virginia, and the latter that of Baltimore, Maryland. The climate of this district is best indicated by the fact that the isotherm 55° F. passes through the northern part of the district, the same temperature line also passing through the peach and sweet potato districts of Delaware and southern New Jersey. The 50° isotherm passes through Illinois about on the dividing line between the northern and central fruit districts, thus showing the mean annual temperature of the northern district to be practically the same as that of the great grape and small-fruit sections of central New York. It should also be noted that the mean annual temperature of the famous Santa Clara Valley and the Santa Cruz mountain wine-grape district is 55° F., or about that of Madison and Bond counties in Illinois.

In 1913 the total annual precipitation at Galena, in the extreme northwest corner of the state, was 32 inches; in Henderson County and from thence along a line northeast across the state and down to Ford and Iroquois counties, 34 inches; in a circle taking in Pike, Adams, Hancock, Fulton, Knox, and up to LaSalle and a little beyond into Kane and DeKalb counties, down to McClean and the northern parts of Champaign and Vermilion counties, then west across the state including DeWitt, Sangamon, and Morgan counties, 34 to 36 inches; directly south, in a section including Clark, Edgar, and the southern part of Vermilion County on the east, and Scott and Calhoun counties on the west, 36 to 38 inches; along a line entering the state in Madison County, bending north to the southern boundary of Macon County and thence southeast to Crawford County, 38 to 40 inches; from thence to the seven or eight extreme southern counties, which have an average precipitation of 46 to 48 inches and over, 40 to 44 inches. The mean annual rainfall for ten years up to and including 1913 at the Illinois Agricultural Experiment Station at Urbana, Champaign County, was 35.37 inches.

In recent years there has been a steadily increasing interest in the apple as a commercial crop. Taking the state as a whole, this fruit is far in advance of other tree-fruits in area planted, in size of individual orchards, and in crop values. The introduction of modern business methods which have in great part supplanted the careless and unprofitable methods common a decade or so ago has brought great changes, and has established commercial apple-culture upon a stable and profitable basis. Attention to cultural methods and details of management is now almost universal; grades of fruit are rapidly being standardized, storage facilities are utilized, and markets carefully studied. Many orchards that were formerly neglected have been renovated and made profitable, and the planting of new apple orchards as commercial ventures is increasing. These new projects evidence study and the effort to apply those fundamental principles that make for success. The varieties planted are few in number, chosen because of their known adaptability to the particular region and their established position in the market to be served. In planting, the varieties are distributed in such manner as to promote interpollination. For the northern and central districts, fall and winter varieties are most in favor for commercial planting, while in the southern district new orchards are largely of summer varieties. In large orchards, cultural operations are now performed by traction engines with such satisfactory results that the use of these tractors promises to become universal in all commercial orchards.

In the southern district of the state there is in progress a notable revival in peach-planting. This fruit was neglected for several years because of losses resulting

from brown-rot, peach-scab, peach leaf-curl, and other diseases. With the demonstration that these diseases could be completely controlled by persistent application of perfected methods of spraying, return to planting began and has extended until the area in new peach orchards equals, if it does not exceed, the area newly planted with apples. Elberta is the variety most in favor for commercial planting.

According to the Census Reports for 1910, Illinois ranks third among the states in value of flowers and ornamental plants produced, and second in value of flower and vegetable seeds. The largest commercial establishment in the United States for the production of cut-flowers is that of Pullman Brothers of Morton Grove (having a total of 45 acres under glass). Chicago has been for years the second largest market in the United States for cut-flowers. The business has grown considerably of late, although exact figures are not obtainable. An interesting fact in this connection is that the Chicago market is supplied almost entirely by Illinois establishments, while the demand in New York City, which is the center of the greatest market for cut-flowers in the country, is met largely by floricultural interests located in New Jersey.

The nursery business is flourishing in Illinois. There are approximately 214 nursery establishments in Illinois which are regulated according to the inspection laws, ninety in the northern division, seventy-four in the central, and fifty in the southern.

Other branches of horticultural industry are also well developed. Gardening for the Chicago market forms a large and important business in itself, while the growing of vegetables for shipment in certain sections of southern Illinois has assumed large proportions. At times, from Cobden, in Union county, thirty cars of tomatoes are shipped in one day, and it is not unusual for sixty to seventy cars of produce to be shipped from that county in one day.

Market-gardening has also been well developed in the vicinity of nearly every city of any considerable size in the state. In a number of the gardens, modern methods of overhead irrigation are employed to supplement the natural rainfall in certain seasons. At many places the culture of vegetables under glass has become an important industry, the principal crops being lettuce and cucumbers. Among the counties of the United States, Cook County, Illinois, ranks first in acreage of cucumbers, third in acreage of cabbage, third in acreage of onions, fourth in acreage of lettuce, fourth in acreage of celery, and fourth in the production of radishes. Union County has a larger acreage of rhubarb than any other county in the United States, while Iroquois County ranks third in acreage of sweet corn. Illinois ranks second among the states in the production of sweet corn, and third in the production of squashes.

Watermelons constitute an important truck-crop in certain localities, the leading centers of the industry being Carmi, in White County, Beardstown, in Cass County, and Thomson, in Carroll County. The normal production in each of these regions is about 400 carloads a year.

Onions, and especially onion sets, are extensively grown in the vicinity of Chicago. Many of the sets are grown in small areas under contract by market-gardeners for seedsmen and other large dealers. However, there are a few growers who make a specialty of sets, and plant a large acreage every year. One firm operating within the city limits of Chicago, ordinarily produces over 200 acres of sets. In the weeding and harvesting seasons, a special train is run to bring their workmen from the city.

The most notable examples of landscape horticulture or landscape gardening in the state are to be found in the Chicago city park system, which is the largest and in some respects the finest in the entire country. A recent development is the promotion of an "Illinois way

of planting," which tends to emphasize the prairie style of landscape gardening as opposed to the formal or gardenesque style, and to unify and give character to the state as a whole.

Most of the men and women who have been influential in promoting the horticultural interests of the state have been identified with the State Horticultural Society. Some of those who are no longer living who will be remembered for their connection with the advancement of the horticultural activities of the state are: H. Augustine, Normal; W. W. Barnard, Johnson; S. N. Black, Clayton; Arthur Bryant, Princeton (page 1567); A. C. Canfield, Springfield; H. L. Daw, Jacksonville; C. N. Dennis, Hamilton; Robert Douglas, Waukegan (page 1572); M. L. Dunlap, Savoy; Samuel Edwards, LaMoille; Geo. Endicott, Villa Ridge; Willard C. Flagg, Moro; O. B. Galusha, Peoria; R. O. Graham, Bloomington; W. H. Gullett, Lincoln; A. C. Hammond, Warsaw; Jas. Hartzorne, Joliet; P. J. Hauswirth, Chicago; Jos. Heintz, Jacksonville; E. S. Hull, Alton; John F. Jolly, Olney; W. B. Lloyd, Kinmundy; W. H. Mann, Gilman; S. G. Minkler, Oswego; J. M. Pearson, Godfrey; Jonathan Perriam, Chicago; G. H. Perrine, Centralia; F. K. Phoenix, Bloomington; Edgar Sanders, Chicago; J. B. Turner, Jacksonville; F. D. Voris, Neoga; and A. Washburn, Bloomington.

Public-service agencies for horticulture.

The land-grant college was established in Urbana, Champaign county, February 28, 1867. The institution was called the "Illinois Industrial University" until 1885, when the name was changed to the "University of Illinois." At first there was no special instruction or equipment in horticulture.

In 1888, the Illinois Agricultural Experiment Station was established at the University of Illinois; the Board of Trustees of the University assumed charge, and some of the farm land belonging to the University was set aside for experimental purposes. At that time there were two members of the horticultural station staff; there are now twenty-two. Experimental work is being carried on in pomology, olericulture, plant-breeding, and floriculture. The area set apart for horticultural interests is 360 acres, about 300 acres of which are devoted to instructional work and about 60 acres to experimental work. This will fluctuate, however, from time to time. Thirty-eight horticultural bulletins have been published by the station to date, and thirty-two circulars.

With the exception of courses in colleges teaching agriculture, no advanced or special instruction in horticulture is given in the state. However, most of the common and secondary schools of the state offer courses in agriculture, in connection with which elementary horticultural instruction is included.

As a result of a state-wide demand for advice upon the improvement of home and public grounds, the Department of Horticulture at the State University has organized a corps of men especially for extension work in landscape gardening. Four members of the staff devote their entire time to this phase of the work. It consists of making special designs for school and other public grounds to serve as illustrations of proper landscape planting in the respective communities, publishing circulars and pamphlets designed to stimulate an interest in rural and civic improvement, giving illustrated lectures at meetings of civic clubs, farmers' institutes, and other organizations, and of demonstration work in the planting of public and private grounds.

Inspection service for insects and plant diseases is provided for by an act of the legislature, now in force as amended July 1, 1909. All nursery stock shipped or delivered must bear a copy of certificate of inspection.

No laws in regard to fruit-grading are now in force in Illinois except those which have been enacted by the federal government. A standard of grading of apples

which is universally followed in the state, however, is that adopted in 1903 by the Illinois State Horticultural Society. According to this standard, apples are graded as No. 1's, No. 2's, and culls.

The horticultural interests of Illinois have been well looked after and carefully placed on a permanent basis by the legislature. In 1874 an act was passed by that body establishing the Illinois State Horticultural Society (which was organized in 1855) as a public corporation of the state. The State Horticultural Society is divided into three subdivisions, the Northern, Central, and Southern Horticultural Societies, each taking in about one-third of the state (see map). For the advancement of floriculture, the Illinois State Florists' Association was incorporated under the laws of the state of Illinois, March 9, 1905.

Statistics (Thirteenth Census).

The approximate land area of Illinois, according to the Census Report of 1910, is 35,867,520 acres. Of this, 90.7 per cent or 32,522,937 acres are in farms; 28,048,323 acres of the farm land are improved; 3,147,879 acres are in woodland; and there are 1,326,735 acres of other unimproved land in farms. The number of farms in the state totals 251,872. The average acreage to the farm is 129.1 acres. [The total area of the state is 56,665 square miles.]

The leading agricultural crops are cereals and hay and forage. In 1909, 59 per cent of the improved land was occupied by the cereals, or 16,536,457 acres. The value of the products from the cereals was \$297,523,098, which was 79.9 per cent of the total value of all the crops. Hay and forage occupied 11.9 per cent of the improved land, or 3,349,435 acres. The value of the products was \$40,560,220, which was 10.9 per cent of the total value of all crops. Crops of lesser importance were broom-corn, which occupied 38,452 acres in 1909, the products of which were valued at \$1,457,172; and the sugar crops, which occupied 16,220 acres, whose products were valued at \$573,846. The value of the forest products of the farms was \$3,325,259 in 1909 and \$2,555,890 in 1899.

Horticultural crops grown are fruits and nuts, vegetables including potatoes, small-fruits, and flowers and plants and nursery products. The value of fruits and nuts grown in 1909 was \$4,304,847, as compared with \$4,168,500 in 1899. The total acreage of potatoes and other vegetables in 1909 was 268,911, and their value \$16,300,654, which is far above the value of any of the other horticultural crops. The acreage of small-fruits was 11,723 in 1909, as compared with 16,794 in 1899, a decrease of 30.2 per cent. The value of the small-fruits in 1909 was \$1,109,747. The raising of flowers and plants and nursery products is of comparative importance, 4,793 acres being devoted to them in 1909 and the product being valued at \$4,517,085.

The total quantity of orchard-fruits produced in 1909 was 4,939,211 bushels, valued at \$3,857,743. Apples produced three-fifths of this quantity, the production in 1909 being 3,093,321 bushels, valued at \$2,111,866. Peaches and nectarines were next in importance of the orchard-fruits, the production being 1,222,570 bushels, valued at \$999,516. In 1909 the production of cherries was 287,376 bushels, valued at \$453,474; that of pears, 249,365 bushels, valued at \$202,965; that of plums and prunes, 78,566 bushels, valued at \$80,384; that of quinces, 6,723 bushels, valued at \$8,037; and that of apricots, 1,250 bushels, valued at \$1,457.

Grapes produced in 1909 amounted to 16,582,785 pounds, valued at \$426,468. The production in 1899 was 20,009,400 pounds.

The total production of all the nuts in 1909 was 714,478 pounds, valued at \$20,550. The most important of the nuts were the pecans, producing 107,069 pounds, valued at \$10,301; the black walnuts, producing 530,730 pounds, valued at \$7,411; and hickory-nuts, producing

60,124 pounds, valued at \$1,954. The nuts of lesser importance were the Persian or English walnuts, the chestnuts, and the butternuts.

Of the small-fruits, strawberries are the most important, with blackberries and dewberries, and raspberries and loganberries ranking second and third, respectively. The acreage of strawberries in Illinois in 1909 was 5,410, producing 8,031,824 quarts of berries, valued at \$613,917; the acreage of blackberries and dewberries was 3,503, producing 2,915,473 quarts of berries, valued at \$237,058; and the acreage of raspberries and loganberries was 1,945, producing 1,834,337 quarts of berries, valued at \$191,401. The small-fruits of less importance that were produced in 1909 were: 541,498 quarts of gooseberries, valued at \$44,238; 265,858 quarts of currants, valued at \$21,863; and 13,418 quarts of cranberries, valued at \$1,248.

Of the vegetables produced in Illinois, potatoes are by far the most important. The acreage in 1909 was 138,052, and the production 12,166,901 bushels, valued at \$6,401,598. The acreage devoted to sweet potatoes and yams was 10,568, the production being 1,050,932 bushels, valued at \$506,760. The acreage devoted to the production of all other vegetables, excluding the potato, sweet potato and yam, was, in 1909, 120,291 and the production was valued at \$9,392,296. The leading vegetables, their acreage, and the value of the product were as follows: sweet corn, 19,976 acres, valued at \$558,746; onions, 3,315 acres, valued at \$546,951; tomatoes, 5,316 acres, valued at \$343,132; cabbage, 5,207 acres, valued at \$341,161; cucumbers, 2,981 acres, valued at \$234,203; watermelons, 6,211 acres, valued at \$188,869; asparagus, 2,241 acres, valued at \$181,557; 231 acres of lettuce, valued at \$153,784. Other vegetables of less importance in 1909 were green beans, beets, cantaloupes and muskmelons, carrots, cauliflower, celery, pop-corn, horse-radish, parsnips, green peas, green peppers, radishes, rhubarb, spinach, and turnips.

The acreage devoted to the growing of flowers and plants has increased from 679 in 1899 to 1,339 in 1909, an increase of 97.2 per cent. The total area covered by glass in 1909 was 15,950,853 square feet, of which 14,380,927 were covered by greenhouses, and 1,569,926 by sashes and frames. The value of the flowers and plants produced in 1909 was \$3,694,801, as compared with \$1,894,960 in 1899.

The acreage occupied by farms and establishments growing nursery products in 1909 was 3,454, as compared with 3,142 in 1899. The value of the products in 1909 was \$822,284, an average value an acre of \$238.07.

J. C. BLAIR.

Michigan.

No state in the Union has greater natural advantages than Michigan (Fig. 2499) and few if any have made more use of them along horticultural lines. Not only are the soil and climate unusually well adapted for the growing of flowers, vegetables and nearly all the deciduous fruits, but excellent shipping facilities are provided.

Almost any kind of soil may be found in every county in the state and often upon the same farm. The sandy-loam soils which are so desirable for peaches, cherries and grapes, are widely distributed, as are somewhat heavier soils for apples, plums, pears and the small-fruits. Even when the soil upon the surface appears so light as to be worthless, a clay subsoil is often found upon which trees of all kinds will grow luxuriantly. Along the shores of Lake Michigan is some of the best fruit-land where the soil is of a sandy nature and absolutely devoid of clay. From this the soil varies through the sandy loams to light and heavy clay loams, to clay soils which when overlying an open subsoil answer well for growing pears, apples and even for the other fruits like peaches, for which it is generally understood that a sandy loam soil is better adapted.

Aside from the nature of the soil itself, the general contour of the land aids in making Michigan a great fruit state. While much of the land is level to the extent of being low and swampy, and still other extensive areas are so steep and rough as to be of little value for the highest type of fruit-culture, a large proportion of the land in nearly every county is gently rolling, with slopes that often extend to points 100 or more feet above the land in the neighboring valleys. This not only provides the needed drainage for water, but favoring the movements of the air, it permits the cold air to pass off to the lower levels, thus lessening the injury from late frosts in the spring as well as from early frosts in the fall, besides making a difference of 5° to 10° in the minimum winter temperatures.

Another horticultural asset of almost inestimable value to Michigan comes from the fact that the state is surrounded on three sides by the waters of the Great Lakes, besides having thousands of inland lakes within her borders. They aid not only in providing almost ideal climatic conditions, but in furnishing quick, cheap and excellent conditions for the transportation of fruit and other perishable products to market.

In addition to the splendid service in the handling of horticultural products provided by the steam and trolley lines, the fruit-grower is favored by the many trans-lake steamship lines, which take the fruit during the night to the market points to which it is consigned in time for the morning market. Not only are there several lines which skirt the eastern shores, but on Lake Michigan there are no less than a dozen lines which take the fruit from twenty or more ports direct to Chicago, Milwaukee and other points, besides a number of minor connecting lines of boats. Besides furnishing regular and comparatively cheap service, the boat-lines make it possible to ship the fruit under almost ideal conditions, in the cool night air of the lake and without the jar and shaking to which it would necessarily be exposed if shipped by rail.

Although in the early times nearly every farm had its home-orchard in which a general variety of fruits was grown, there were very few that could be called commercial orchards, except in the counties bordering upon Lake Michigan. The peach in particular was an exception, and to such an extent that the region from Benton Harbor to Grand Haven was known as the Michigan Fruit-Belt, or Peach-Belt, but it was soon learned that this region by no means included all of the land in Michigan that was suited to commercial orcharding. While by far the larger area is still in the southern half of the lake-shore counties, extensive orchards of the peach and other fruits are now found all along the shore as far north as Charlevoix, and especially about Ludington, Manistee, Frankfort and Traverse City. The planting, however, has not been confined to the counties bordering upon Lake Michigan, some of the largest orchards in the state being in Newaygo, Kent, Barry, Kalamazoo, Oakland, Livingston and other interior counties. The principal requirements being a moderately rich and well-drained soil and a location considerably above the land immediately surrounding it, these can and are being met in nearly every county in the lower peninsula, although there are very few commercial peach orchards in the northern half of the state, except within 20 miles of Lake Michigan.

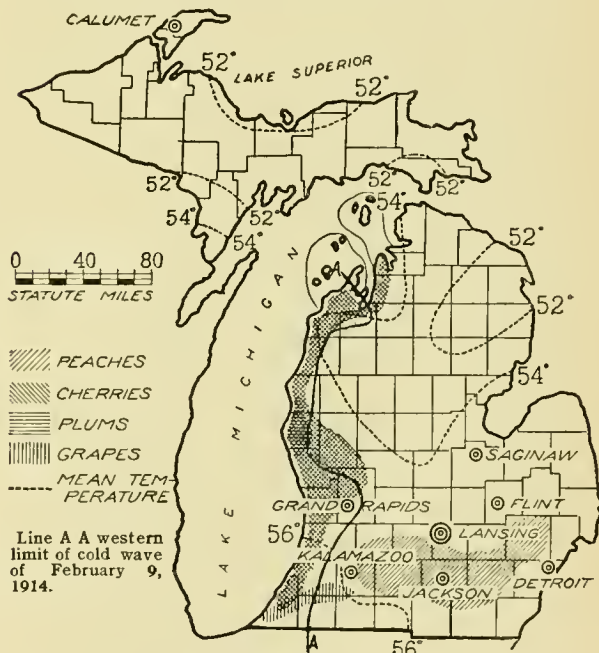
Plums, also, have been very generally planted, although the acreage is much smaller than that of peaches. The southern lake-shore counties are giving especial attention to this crop, the largest areas being in Oceana, Allegan, Berrien, Mason, Kent, Van Buren and Ottawa counties. Under proper care the crop is a profitable one, but from lack of proper spraying and the resulting loss of the foliage from leaf-blight, many of the trees are seriously injured and often killed by the winter.

While the sour varieties of cherries do well in almost

all of the Michigan counties, the northern half of the western lake-shore counties seem to be especially suited to them and very large plantings have been made, particularly about Traverse City, Manistee, Frankfort, Northport and Charlevoix. The same region is also well adapted to the sweet cherry and extensive plantings have been made. The trees seem to be hardy, bear profusely and the fruit readily finds a market at about twice the price of the sour varieties.

Vineyards of considerable extent are found in most of the southern counties, but from a commercial standpoint Berrien and Van Buren counties take the lead, and grapes from the Lawton and St. Joseph grape regions are shipped to nearly every state in the Union. Kent, Cass, Ottawa, Allegan, Monroe, and Kalamazoo counties also have many extensive vineyards.

Nearly every county in the southern peninsula has large commercial apple orchards and nearly three-



2499. Michigan, showing horticultural parts or districts.

fourths of them have 100,000 trees or more. Although they are being very generally planted all over the state, the more extensive plantings are along the western border. The largest percentage of increase has been in Manistee, Benzie, Leelanaw, Grand Traverse, Antrim, Charlevoix and Cheboygan counties. Large plantings of the Oldenburg have been made in the more southern counties, this variety for a number of years having been exceedingly profitable.

While six of the southern lake-shore counties grow more small-fruits than all the remainder of the state, these being the only ones which have over 800 acres, there are at least thirty counties in which 100 acres or more are grown. The northern part of the state, including the upper peninsula, is coming to the front with its late varieties of strawberries which come on after the season is over in the southern counties, and these with the "everbearing" kinds make it possible in some seasons to have Michigan-grown strawberries for six months of the year.

As the years go by, the growing of fruit becomes more and more the work of specialists. It has been found that the slipshod methods formerly in vogue will not give results, and with greater attention to the selection of

orchard-sites, a better choice of varieties, and with up-to-date methods in caring for and spraying the trees, and in picking, grading and packing the fruit, a new era in Michigan fruit-culture seems at hand.

While the development in fruit-culture in Michigan has been rapid, even greater progress has been made in the cultivation of flowers and vegetables under glass. For the most part the larger commercial greenhouses are located near Detroit or Grand Rapids, but every city and many of the villages have greenhouses used for commercial purposes. The houses of today are twice as large in each of their dimensions as thirty years ago. Michigan also has the first full-sized, portable, commercial greenhouse ever constructed, at Redford, near Detroit.

Equal progress has also been made in the size of the flowers, and many of the varieties of roses, carnations and chrysanthemums developed by Michigan specialists have also doubled. There is a large wholesale trade in all of the above as well as in violets and sweet peas. The florists' plant business is also rapidly increasing. In addition to the local demand, the reputation of the Michigan growers brings orders for chrysanthemum, carnation, rose and geranium plants from all parts of the country. Several gladiolus, dahlia and canna specialists also do a large plant business.

The attention given to the growing of greenhouse vegetables has also increased. At Grand Rapids alone, 1,500,000 square feet of glass are used for this purpose, the business giving employment to 600 men. The loose-leaf, curled variety of lettuce, known as Grand Rapids Forcing, is the only kind used. Three crops are grown each year, the last crop being followed by tomatoes, cucumbers or parsley. The heads are packed in paper-lined barrels and shipped in refrigerator cars to points as far distant as Buffalo, Cincinnati and Louisville.

Many years ago Kalamazoo became known for the fine celery grown there, but there are hundreds of points where an equally fine article is produced today. Many thousand tons are shipped in carload lots and by express all over the country. The soil generally used for this crop is muckland which has been drained, but where the water stands within 2 feet of the surface, thus affording sub-irrigation for the crop. Nearly every city and large town has celery gardens to supply the local demand and many of them do a large shipping business.

There are also many crops commonly classed as garden vegetables which are grown upon such extensive plans as almost to become field-crops. Among them are cabbages, onions, watermelons and muskmelons, garden peas, beans, asparagus, and potatoes. For cabbages and onions, as well as for the growing of celery, the clearing of thousands of acres of swampland has furnished almost ideal conditions, and hundreds of carloads are shipped out of the state after supplying the local demand. There are several "kraut" factories in the state, each of which uses several hundred tons of cabbages.

Michigan also leads all other states in the acreage of garden peas and beans, there being an enormous amount used by the canning factories, besides what are required for local consumption and for shipping in the fresh state. In field beans the crop equals the combined yield of all of the other states, and the yield of potatoes is excelled by few, if any, states.

In addition to the area used for the growing of the above-mentioned crops for food purposes, large tracts are devoted to the production of seeds, the quality of Michigan-grown seed being generally recognized by seedsmen who send there for their supply. It is estimated that not less than 15,000 acres are used for growing seed of garden varieties of peas, 10,000 acres for garden beans, 2,000 acres for sweet corn, with 1,000 acres of cucumbers, 1,000 acres of melons, 500 acres of tomatoes, besides large areas devoted to onion, radish, cabbage and other vegetable seeds.

Reference has been made to the use of peas and beans by canning factories, but they also require immense quantities of other vegetables, such as asparagus, rhubarb, sweet corn, pumpkins, squashes, and tomatoes, to say nothing of the cucumbers, onions, and peppers used for pickling. The length and breadth of the state is dotted with salting and pickling stations, the number being little if any less than one thousand. The canning factories also use hundreds of thousands of bushels of strawberries, raspberries, blackberries, gooseberries, cherries, plums, peaches, pears and apples.

To furnish trees for the orchardists in this and other states, there are more than 100 nurseries, from which trees, shrubs and fruit-plants are sold. Several of the larger nurseries are located at Monroe, in the southeast corner of the state, where the soil seems to be especially adapted for the growing of trees. There are also nearly fifty firms which make a specialty of growing and selling small-fruit plants.

Although one generally thinks and speaks especially of the lower peninsula as the horticulturist's paradise, there is an immense area between Lake Michigan and Lake Superior which presents strong claims for recognition. While the climate is severe for the more tender species and varieties, the hardier kinds of apples, cherries and plums, as well as the small-fruits, do remarkably well. The fruit excels in color and flavor, and this section has a promising future horticulturally.

To mention the men who have done most to promote the horticultural interest of Michigan one would have to write a history of horticulture in nearly every county. B. Hathaway, of Little Prairie Ronde, C. Engle, of Paw Paw, and Geo. Hosford, of Ionia, have been especially successful in developing new varieties of fruit; I. E. Ilgenfritz, of Monroe, L. G. Bragg, of Kalamazoo, and N. P. Husted, of Lowell, were for many years the proprietors of the largest nurseries in the state; R. M. Kellogg, of Three Rivers, worked for years to develop improved strains of strawberries and for better methods of culture; C. D. and G. W. Lawton were pioneers in the grape industry at Lawton; J. G. Ramsdell and George Parmelee did much to develop an interest in fruit-culture in the Grand Traverse region, and L. H. Bailey was for years the leading apple-grower at South Haven. More than anyone else, T. T. Lyon fostered the interests of horticulture in Michigan (see Volume III, page 1585).

Public-service agencies for horticulture.

The Land-Grant College of Michigan is located at East Lansing, and was established in 1855. There are six members of the horticultural staff.

The Experiment Station is also situated at East Lansing and the horticultural force consists of six members. Four or five bulletins on horticultural subjects are published each year. Branch stations, at which considerable attention is given to horticulture, and to fruit-growing in particular, are maintained at South Haven and at Chatham in the upper peninsula.

Extension work is conducted in horticulture, by means of farmers' institutes, extension schools and the like. There are also three men connected with the extension service of the College who give especial attention to horticulture. They are specialists in fruit-growing, the control of insects and diseases, and potato-growing and truck-gardening.

Horticulture forms a part of the curriculum at the state normal schools at Kalamazoo and Mt. Pleasant and at the Menominee and Chippewa county agricultural schools, and is given considerable attention at fifty high-schools which have an agricultural department.

The work of the State Horticultural Society in furthering the horticultural interests should not be overlooked. Established in 1870 as the State Pomological Society, its field of work gradually broadened until 1880

when the name changed to "The State Horticultural Society." There are also in Michigan some twenty local county or district horticultural societies, auxiliary to the State Society. A number of cooperative organizations have been organized for the purpose of providing for a better distribution of fruit, securing improved transportation facilities, shipping in carload lots, and so far as possible selling direct to the retailer. There have been three associations which have handled the grapes in the Lawton district for a number of years to the general satisfaction of the growers, and while some among the other associations have been more or less failures, in many instances excellent results have been attained.

The State Board of Agriculture is in charge of the nursery and orchard inspection and the enforcement of the laws relating to the spraying for dangerous insects and diseases.

Statistics (Thirteenth Census).

The approximate land area of Michigan in 1910 was 36,787,200 acres. The land in farms was 51.5 per cent of the land area, or 18,940,614 acres. Of the land in farms, 12,832,078 acres were improved land; 2,927,554 were woodland; and 3,180,982 acres other unimproved land. The total number of farms in 1910 was 206,960. The average number of acres to a farm was 91.5. [The total area is 57,980 square miles.]

The leading agricultural crops of the state are cereals, hay and forage, and forest products of the farms. Cereals, in 1909, occupied 34.4 per cent of the improved land, or 4,415,629 acres. The value of the cereals in 1909 was \$70,544,250, or 43.5 per cent of the total value of all crops. Hay and forage, in 1909, occupied 21.2 per cent of the improved land, or 2,715,301 acres, and the value of hay and forage for the same year was \$36,040,087, or 22.2 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was \$7,911,901, as compared with \$7,530,369 in 1899. Sugar beets are also grown extensively, particularly in the "Thumb" section of the state, the acreage increasing from 40,624 in 1899 to 79,195 in 1909, an increase of 94.9 per cent, when the value of the production was \$4,032,718.

Horticultural crops grown are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts grown in 1909 was \$10,570,855, as compared with \$4,186,549 in 1899. Small-fruits decreased in acreage from 29,197 in 1899 to 21,414 in 1909, a decrease of 26.6 per cent, when the total value was \$2,028,865. In 1909 the total acreage of potatoes and other vegetables was 456,368 and their value \$16,201,328. The acreage of vegetables, excluding potatoes, was 90,861, an increase of 58 per cent over the acreage in 1899, and the value of these vegetables in 1909 was \$6,286,645. Flowers and plants and nursery products increased in acreage from 2,060 in 1899 to 3,736 in 1909, an increase of 81.4 per cent, when their value was \$1,786,538.

The total quantity of orchard-fruits produced in 1909 was 15,220,104 bushels, valued at \$9,020,842. Apples contributed about four-fifths of this quantity, peaches and nectarines and pears most of the remainder. The number of apple trees of bearing age in 1910 was 7,534,343; those not of bearing age, 2,253,072. The production in 1909 was 12,332,296 bushels, valued at \$5,969,080. The peach and nectarine trees of bearing age in 1910 numbered 2,907,170; those not of bearing age, 2,991,090. The production in 1909 was 1,686,586 bushels, valued at \$1,700,330. The number of pear trees of bearing age, in 1910 was 1,136,151; those not of bearing age 623,931. The production in 1909 was 666,023 bushels, valued at \$535,771. The production of cherries in 1909 was 338,945 bushels, valued at \$590,829; that of plums and prunes 181,188 bushels, valued

at \$205,765; and that of quinces 13,484 bushels, valued at \$16,858.

The production of grapes in 1909 was 120,695,997 pounds, as compared with 41,530,369 pounds in 1899. The value of grapes in 1909 was \$1,531,057. The grapevines of bearing age in 1910 numbered 11,013,576; those not of bearing age, 1,869,648.

The total production of nuts in 1909 was 961,137 pounds, valued at \$18,956. Most of the nuts consisted of black walnuts, hickory-nuts, and chestnuts, there being 546,779 pounds of black walnuts produced, valued at \$7,804; 276,015 pounds of hickory-nuts, valued at \$6,681; 112,488 pounds of butternuts, valued at \$1,552; and 23,369 pounds of chestnuts, valued at \$2,762.

Strawberries are by far the most important of the small-fruits raised in Michigan, with raspberries and loganberries, and blackberries and dewberries ranking second and third respectively. The acreage of strawberries decreased from 10,837 in 1899 to 8,051 in 1909, when the production was 14,218,768 quarts, valued at \$1,000,788. The acreage of raspberries and loganberries decreased from 10,193 in 1899 to 8,786 in 1909, when the production was 8,381,943 quarts, valued at \$695,019. The acreage of blackberries and dewberries also decreased from 4,385 in 1899 to 2,973 in 1909, when the production was 3,075,954 quarts, valued at \$218,174. There were also produced 768,259 quarts of currants, valued at \$58,288; 403,680 quarts of gooseberries, valued at \$28,932; and 125,536 quarts of cranberries, valued at \$6,992.

Of the vegetables, potatoes are by far the most important. The acreage increased from 311,963 in 1899 to 365,483 in 1909, when 38,243,828 bushels were produced, valued at \$9,913,778. Dry edible beans are grown in Michigan also. In 1909 the acreage was 403,669, from which were harvested 5,282,511 bushels, valued at \$9,716,315. Dry peas were produced to the amount of 1,162,403 bushels, valued at \$1,337,430. Other vegetables of importance grown in 1909 were: 2,850 acres of celery, valued at \$488,610; 7,061 acres of cucumbers, valued at \$342,042; 4,314 acres of cabbage, valued at \$257,144; 2,850 acres of tomatoes, valued at \$217,256; 5,726 acres of sweet corn, valued at \$147,762; 1,829 acres of cantaloupes and muskmelons, valued at \$146,801; 1,130 acres of onions, valued at \$146,507; and 4,548 acres of green peas, valued at \$102,263. Vegetables of lesser importance were asparagus, green beans, beets, carrots, cauliflower, pop-corn, horse-radish, lettuce, parsnips, green peppers, radishes, rhubarb, rutabagas, squash, turnips and watermelons.

The acreage devoted to the production of flowers and plants increased from 220 acres in 1899 to 702 in 1909, an increase of 219.1 per cent. The total area under glass in 1909 was 4,122,099 square feet, of which 3,922,772 were covered by greenhouses and 199,327 by sashes and frames. The value of the products in 1909 was \$1,143,764.

The acreage devoted to nursery products increased from 1,840 in 1899 to 3,034 in 1909, an increase of 64.9 per cent, when the value of the nursery products was \$642,774.

L. R. TAFT.

Wisconsin.

The surface of the state of Wisconsin (Fig. 2500) is, in general, one of low relief. The lowest parts are about 600 feet and the highest nearly 2,000 feet above sea-level. In the southwest quarter of the state—the unglaciated part—differences in elevation from 200 to 500 feet within a distance of a mile or two are common, and the area is hilly in general. In this hilly part of the state, the drainage is perfect. There are no swamps or lakes, and, while the soil in some parts is sandy, it is mostly a rich clay and loam derived from the decay of limestone. In the glaciated part of the state the surface is undulating, local relief of more than 100 feet

being uncommon. The drainage is characteristic of glacial areas, being poorly developed, so that there are numerous marshes and small lakes. The soil presents all variations in character, but is mostly very fertile.

According to Whitson and Baker, the mean annual temperature of the state is 43.3° , varying from 48° for the southwest corner to 39° for the northeastern part. According to the seasons, the mean temperature is as follows: Winter, 17° ; spring, 42° ; summer, 67° ; fall, 47° . Southern Wisconsin has a summer temperature similar to that of central France, southern Germany and the Danube Valley, while northern Wisconsin is about as warm in summer as London or Berlin. The winter temperature of the state, however, resembles that of Sweden and central Russia. The length of time from

parent orchards and gardens. The Baldwin apple and the Flemish Beauty pear, standards in Massachusetts and New York, are likewise standards in Ohio, Indiana and Michigan. Horticulture in these states has been and is now merely an extension of horticulture in the eastern states. In Wisconsin and the upper Mississippi Valley, it has been an evolution.

The first gardens in Wisconsin, planted by civilized people, were at Green Bay and on Madeline Island, one of the Apostle group. At these places the Jesuit missionaries or their followers planted gardens, not alone of vegetables but seeds of the apple and cherry. Along the shores of Madeline Island may still be found thickets of cherry, offspring of the seedling trees planted by the missionaries.

Real horticulture dates from the coming of settlers from the eastern states, 1830 to 1840, who brought eastern varieties of apples, such as Baldwin, Greening, Bellflower, King and others. These did not long persist on the black alluvial soils first preempted by the early settlers; long winters, often with but little snow, soon wiped out most of the early planted orchards until it came to be generally believed that tree-fruits could not be grown in Wisconsin. The rougher broken sections of the state were settled later, and here orchards planted in 1845 to 1855 still stand.

The introduction of the Russian varieties was the cause of another set-back, at least delaying the development of commercial horticulture in Wisconsin for a generation. The Russian apples all proved hardly enough but also proved generally worthless. Something of value resulted, as there have been saved as standard sorts Duchess, Astrachan, Longfield, Yellow Transparent and a few others, but the loss was greater than the gain.

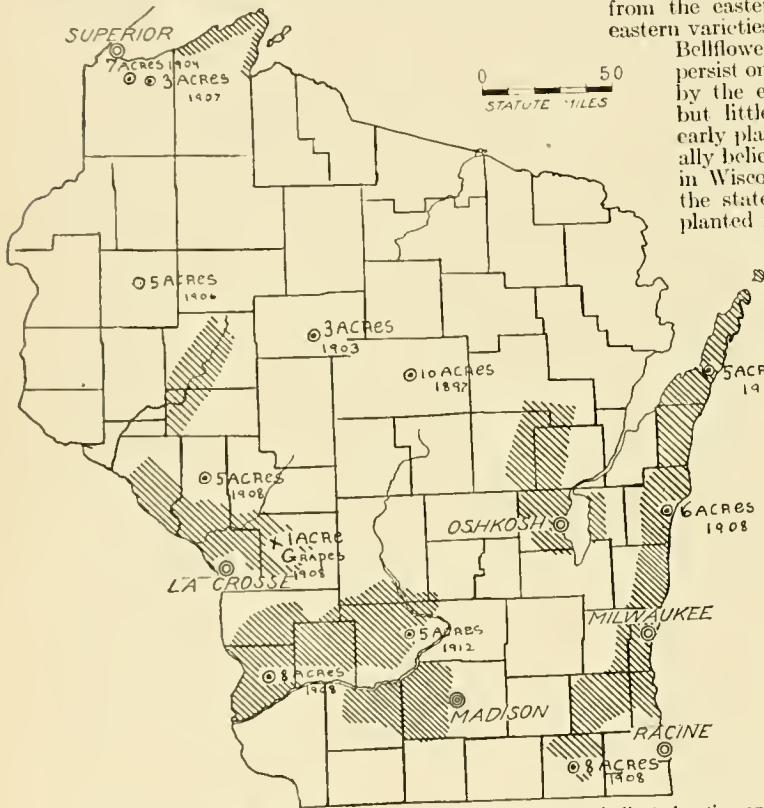
During these two periods, however, there were many earnest men who were not content to wait but, by planting seeds, picking up strays from fence-corners, testing, discarding, created, as a result of fifty years' effort, a new race of fruits belonging to the state and a part of it. The inhabitants of the upper Mississippi Valley owe almost all their horticulture to the tireless, painstaking efforts of these pioneers.

The following fruits, all recognized as standards in Wisconsin and Minnesota and many of them adopted by other fruit sections, were

all originated in Wisconsin: Apples—Gem, Newell, Plumb Cider, McMahan, Northwestern Greening, Windsor, Milwaukee, Pewaukee, Wolf River. Crabs—Brier, Gibb. Plums—De Soto, Springer. Grapes—Janesville. Blackberries—Ancient Briton, Stone. Raspberries—London. Strawberries—Jessie. From Minnesota, Wisconsin growers have the Wealthy; from Iowa, the Patten Greening; and from Maine, the Dudley apples.

The period of evolution occupied fully fifty years from the forties to the nineties and was almost wholly confined to amateur lines, the home orchard and garden. In the past ten years the business of growing fruit for market has developed very rapidly. While in 1902, a 60-acre apple orchard was the largest in the state, orchards of 75 to 100 acres are not now uncommon.

The principal orchard sections of the state comprise parts of Bayfield, Door, Chippewa, Waupaca, Sauk, Richland, and Crawford counties in addition to the counties south of Door bordering on Lake Michigan. Some of the best apple lands in the state are to be found



2500. Wisconsin, to show horticultural regions; the point-circles indicate location and acreage of trial orchards maintained by the State Horticultural Society.

frost to frost varies widely, ranging from 175 to 75 days. Thus, the length of the frostless period at Beloit and Madison is as long as in the higher hills of Georgia or the Valley of Virginia. It is worthy of note that the growing season at both Bayfield and Sturgeon Bay is longer than that at North Yakima, Washington, and Hamilton, Montana, and equal to that at Montrose; while the season at Milwaukee and Madison is about the same as at Rochester, New York."

Wisconsin has an average yearly rainfall of 28 to 34 inches, about one-half of which is in May, June, July and August, and 70 per cent April to September.

Any survey of horticulture in Wisconsin must include an outline at least of its history, for the development or rather the evolution of horticulture in Wisconsin constitutes one of the most interesting chapters in the annals of American horticulture.

In the middle western states, orchards and gardens simply moved westward from their original homes along the Atlantic coast and are now merely replicas of the

on the ridges bordering the valley of the Kickapoo River in Crawford County. These unglaciated ridges extend from Wauzeka to La Farge, west to the Mississippi and east to Richland County. Several thousand acres of commercial apple orchards are now being developed in this section. Probably the most remarkable phase in the development of commercial horticulture in Wisconsin is the extensive planting of tree-fruits in Door and Bayfield counties, both north of the 45th parallel. The acreage of tree-fruits at the present time in Door County exceeds 7,500 largely sour cherries, including one plantation of 670 acres of Montmorency and Early Richmond. The Bayfield district comprises a narrow strip along the shore of Lake Superior from 2 to 5 miles wide and extending north and west from Washburn to the east line of Douglas County. Over 600 acres of apples and cherries are now planted here in addition to an equal or greater acreage of small-fruits. The success of fruit-growing in these districts is clearly due to the modifying influence of lakes Superior and Michigan.

Pears are not extensively grown in Wisconsin on account of lack of hardness of the tree as well as the ravages of fire blight.

The americanas are the only plums that can be depended upon to bear fruit regularly in all parts of Wisconsin. The harder sorts of the European plum, *Prunus domestica*, and of the Japanese plum, *Prunus triflora*, are fairly fruitful in the eastern part, notably in Door and Kewaunee counties. The trees of the last two species, as of those of *Prunus hortulana* and *Prunus angustifolia*, endure the winters throughout the state, but the flower-buds are destroyed whenever the thermometer registers much lower than 20° below zero.

The peach and apricot are not fruitful in any part of Wisconsin except after unusually mild winters. The trees are frequently grown in gardens, and sometimes attain considerable size, but they freeze back more or less in the average winter. Trees of the apricot, imported from Russia, have been frequently planted in Wisconsin, by way of experiment, but are nowhere fruitful. Even if the flower-buds escape destruction, the fruit almost invariably falls soon after setting.

The grape, with winter protection, is successfully grown throughout southern and eastern Wisconsin, when planted on light soil, with southern exposure.

Strawberries and other small-fruits are grown in sufficient quantities to supply local markets and, in addition, from 250 to 300 carloads are shipped annually to Minnesota and the Dakotas, mainly from Sturgeon Bay, Bayfield and Sparta.

Huckleberries and blueberries are extensively gathered from wild plants in certain parts of west-central Wisconsin, and are shipped in large quantities to cities of the Northwest. Wisconsin is one of the chief cranberry-producing states. In parts of Wood, Adams, and Juneau counties, and in less degree in Waupaca and Green counties, the cranberry plant was native over very large areas, and before the settlement of the country the Indians gathered the fruit extensively in bearing years. Latterly, the wild marshes have been largely improved by clearing and providing flooding facilities. In some seasons the total output of cranberries from Wisconsin has aggregated nearly 100,000 barrels. The varieties grown are mostly native, and the quality and keeping of the fruit are excellent. In the years 1894 and 1895, the cranberry industry of Wisconsin suffered a serious check by the destruction of many marshes by fire during an exceptionally dry period. But the business is rallying and may, in a few years, recover its former magnitude.

The trucking industry is confined largely to the southeastern part of the state, mainly Racine, Kenosha and Milwaukee counties.

Wisconsin is one of the leading cabbage-producing states of the country, shipping annually over 5,000

carloads of the hard winter varieties. Domestic cabbage are also produced in large quantities for the manufacture of kraut. The principal producing counties are: Brown, Columbia, Kenosha, LaCrosse, Milwaukee, Outagamie, Pierce, Racine, Rock, St. Croix, and Wood. Outagamie is probably the heaviest producer, about 40,000 tons being the annual production of recent years. Within the past few years the cabbage industry of the southeastern part of the state has been threatened with destruction, owing to the ravages of a relatively new disease known as "yellows." By selection, a disease-resistant strain of winter cabbage has been secured which stands up almost perfectly under the most adverse disease conditions. This strain has been distributed under the name "Wisconsin Hollander." Further trials show that similar disease-resisting strains of the other commercial types are obtainable.

The onion industry of Wisconsin centers along the lake shore in Kenosha, Racine, and Milwaukee counties, and is extending into other sections. The types of onions usually grown are the Red and Yellow Globe, although the white onions are raised to a certain extent. The land best adapted for this crop is rather limited, about 600 acres being raised annually at the present time. Owing to the profitableness of this crop, the acreage is tending to increase. The yield to the acre varies greatly with the fertility of the soil and the care given the plants in their early growth. The average yield is above 400 bushels an acre with occasional yields running over 700 bushels. With fair market conditions, the growers receive \$200 to \$500 an acre.

Forty-three per cent of all canned peas in the United States are produced in Wisconsin. In 1909, this state produced 1,165,055 bushels of dry peas, more than any other state.

Coincident with the extension of fruit-planting has come the development of selling organizations. Fruit-selling associations, purely cooperative in character, have been in successful operation for several years at Sparta, Sturgeon Bay and Bayfield.

In esthetic horticulture Wisconsin compares favorably with any other state. The park systems of the larger cities receive liberal support both from the municipalities and private gifts. About Geneva Lake, in the southeastern part of the state, are the summer homes of many wealthy persons, largely residents of Chicago. Here may be found some excellent examples of landscape art and architecture.

Public-service agencies for horticulture.

The College of Agriculture is located at Madison. The Department of Horticulture was organized in 1889, and is one of the most potent forces in the development of horticulture in the state. There are eight teaching members of the horticultural staff.

The Experiment Station is also at Madison. The research work is varied, dealing with particular problems in the culture of the various horticultural crops. Most of this work is carried on at Madison but a portion of it is done in connection with the work at the branch stations. Considerable work has been done with variety testing of fruits.

The extension service is of more recent development. Three members of the staff give most of their time to this line of work. The organization of community centers for the growing of pure potato seed stock, inspection and certification of potatoes, orchard rejuvenation, spraying demonstrations, tobacco seed-bed sterilization, home and school ground improvement, lectures and garden and fruit schools are some of the lines of activity of the department.

The office of State Entomologist was created in 1915, and has sole charge of the nursery and orchard inspection, the inspection of apiaries and the examination and analysis of insecticides and fungicides. This office is also authorized to engage in extension work.

The Wisconsin State Horticultural Society, organized in 1865, and chartered by the state in 1871, maintains a bureau of information and answers all questions on fruit-growing submitted to the secretary. In addition, the Society maintains ten trial orchards or demonstration stations for the purpose of testing the adaptability of varieties to the soils and climates of these particular regions. In addition to its annual report, it issues a monthly magazine "Wisconsin Horticulture." This Society is purely an educational institution and its purpose is the advancement of every branch of horticulture in the state.

Statistics (Thirtieth Census).

The approximate land area of Wisconsin in 1910 was 35,363,840 acres. The land in farms was 59.6 per cent of this area, or 21,060,066 acres. Of this land in farms, the improved land numbered 11,907,606 acres; the woodland, 5,377,580 acres; and other unimproved land in farms, 3,774,880 acres. The number of all the farms in 1910 was 177,127, and the average acreage to a farm, 118.9. [The total area is 56,066 square miles.]

The leading agricultural crops grown in Wisconsin are cereals, hay and forage, and tobacco. Cereals decreased in acreage from 5,376,944 in 1899 to 4,951,066 in 1909, when the production was valued at \$73,111,919, or 49.3 per cent of the total value of all crops. Hay and forage increased in acreage from 2,397,982 in 1899 to 3,079,102 in 1909, when the production was valued at \$40,866,396, or 27.5 per cent of the total value of all crops. Tobacco increased in acreage from 33,830 in 1899 to 40,458 in 1909, when the production was valued at \$3,855,033. The value of the forest products of the farms in 1909 was \$9,559,428, as compared with \$6,116,033 in 1899.

Horticultural crops grown in Wisconsin are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$2,130,935, as compared with \$284,024 in 1899. Small-fruits decreased in acreage from 12,389 in 1899 to 6,305 in 1909, when the production was 9,782,779 quarts, valued at \$765,437. The total acreage of potatoes and other vegetables in 1909 was 360,312, and their value, \$12,511,816. Excluding potatoes, the acreage of other vegetables increased from 39,578 in 1899 to 70,123 in 1909, when the production was valued at \$4,593,565. Flowers and plants and nursery products increased in acreage from 930 in 1899 to 1,007 in 1909, when the production was valued at \$893,866.

The total quantity of orchard-fruits produced in 1909 was 2,343,517 bushels, valued at \$2,087,202. Apples contributed about 95 per cent of this quantity, and cherries most of the remainder. Apple trees of bearing age in 1910 numbered 2,430,232; those not of bearing age, 1,408,726. The production in 1909 was 2,232,112 bushels, valued at \$1,896,681. The number of cherry trees of bearing age in 1910 numbered 290,495; those not of bearing age, 148,775. The production in 1909 was 81,340 bushels, valued at \$152,119. The production of other orchard-fruits in 1909 was: 15,907 bushels of plums and prunes, valued at \$20,944; 12,992 bushels of pears, valued at \$16,551; 956 bushels of peaches and nectarines, valued at \$552; 100 bushels of apricots, valued at \$211; and minor quantities of quinces and mulberries.

The production of grapes in 1909 was 701,329 pounds, valued at \$25,537. The vines of bearing age in 1910 numbered 148,348; those not of bearing age, 63,098.

The total production of nuts in 1909 was 609,428 pounds, valued at \$18,196. The nuts contributing to this production were: 496,722 pounds of hickory-nuts, valued at \$15,954; 86,086 pounds of black walnuts, valued at \$1,617; and 20,310 pounds of butternuts, valued at \$450.

Strawberries are the most important of the small-

fruits produced in Wisconsin, with cranberries second in importance. The acreage of strawberries decreased from 3,508 in 1899 to 2,863 in 1909, when the production was 5,188,117 quarts, valued at \$431,971. Cranberries decreased in acreage from 5,821 in 1899 to 1,689 in 1909, when the production was 2,549,344 quarts, valued at \$127,212. Raspberries and loganberries decreased in acreage from 1,616 in 1899 to 964 in 1909, when the production was 1,053,889 quarts, valued at \$114,578. Other small-fruits produced were: 498,119 quarts of blackberries and dewberries, valued at \$48,707; 383,982 quarts of currants, valued at \$31,078; and 107,708 quarts of gooseberries, valued at \$8,751.

Potatoes, the most important of the vegetables in Wisconsin, increased in acreage from 256,931 in 1899 to 290,185 in 1909, when the production was 31,968,195 bushels, valued at \$7,917,754. The production of the most important of the other vegetables was: 10,506 acres of cabbage, valued at \$686,296; 11,182 acres of green peas, valued at \$321,324; 650 acres of onions, valued at \$95,595; 3,789 acres of sweet corn, valued at \$83,502; 1,563 acres of cucumbers, valued at \$82,735; 363 acres of tomatoes, valued at \$12,300; 137 acres of celery, valued at \$36,570; 187 acres of cantaloupes and muskmelons, valued at \$25,591; 685 acres of turnips, valued at \$19,888; 497 acres of green beans, valued at \$16,067; 87 acres of asparagus, valued at \$11,498; and 168 acres of watermelons, valued at \$11,355. Vegetables of less importance are beets, carrots, cauliflower, popcorn, horse-radish, radishes, rutabagas, and spinach.

The acreage devoted to the production of flowers and plants increased from 194 in 1899 to 252 in 1909. The total area under glass in 1909 was 2,007,310 square feet, of which 1,875,858 were covered by greenhouses and 131,452 by sashes and frames. The value of the flowers and plants produced in 1909 was \$592,839, as compared with \$270,872 in 1899.

Nursery products increased in acreage from 736 in 1899 to 755 in 1909, when the products were valued at \$301,027, as compared with \$85,087 in 1899.

FREDERIC CRANFIELD.

WEST NORTH CENTRAL STATES.

Minnesota.

The surface of Minnesota (Fig. 2501) is gently undulating, except in the extreme northwestern part, where, in the Red River Valley, are large, fertile, level prairies. Its roughest agricultural land is found in the eastern part, along the Mississippi River, and in many places the bluffs reach a height of 400 feet above the valley. About one-half the state, embracing the northeastern and eastern parts, was originally heavily timbered, and much timber still remains in the northeast, while many scattered groves of timber will be found elsewhere, especially along the rivers.

There are many lakes, the number of which has been estimated at 10,000. These lakes and the timber in the northern part of the state afford excellent camping-grounds and are visited by thousands of people from the cities of the state and from many states farther south. They are especially numerous in the central and northern parts, where they greatly modify the climate of lands in their vicinity. There are great variations of climate between the extreme northern half, where the summers are very short, and the southern half, where killing frosts seldom occur before the first of October. The winters are generally pleasant, but occasionally severe, and 40° below zero is sometimes experienced.

The soil is generally rich and well adapted to a variety of crops, but it is very variable, and there are some extended areas in the northern part where there is much sandy land that should never be used for agriculture, but should rather be devoted to forestry or turned into forest and game preserves. The undulating surface,

variety of good soil and vegetation, and abundance of lakes, afford many very picturesque and beautiful locations for successful horticulture.

The annual precipitation averages about 25 inches, and is well distributed during the growing season. The snowfall is light, and what falls remains usually during the winter. The spring usually opens early, and the transition from winter to spring is very rapid. The soil at St. Paul and southward can generally be worked by April 15, and frequently earlier. The summers and autumns are bright and sunny, and vegetation grows with great rapidity.

Currants, gooseberries, raspberries, blackberries, strawberries, junberries, americana plums, and the frost or river-bank grapes are native fruits that are found wild in abundance in favorable locations throughout the

cultivation. The varieties of the eastern and central states generally prove a failure here. The Duchess of Oldenburg is the standard of hardiness in apples, and can be grown successfully in good locations as far north as St. Paul, and in a small way 100 miles farther north. The Talman Sweet is raised to some extent, but is liable to suffer in severe winters. The Minnesota seedling apple known as the Wealthy is generally the most profitable kind grown. (See *Gideon*, page 1577.) A great many Russian varieties were formerly planted, but have proved unsatisfactory in most cases and very few are now grown. The hardest variety of this origin so far found is the Hibernial, which represents a class of sour autumn apples that will thrive on suitable soil in almost any part of the state. The Charlamoff is another very hardy early autumn apple of the same class. Such hybrid crabs as the Transcendent, Gideon No. 6, Minnesota, Florence and Lyman, may be successfully grown in suitable locations and soil over most of the state. Considerable attention is being given to top-grafting on hardy stocks, such as Virginia, Hibernial and Gould Crab. This has proved a good method in many

parts of the state and in the northern part appears to be the best way to establish apple orchards. Some good-sized apple orchards are found along the Mississippi River in southeast Minnesota and in the Lake Minnetonka regions. The fruit associations about Lake Minnetonka alone do a business of \$50,000 to \$75,000 a year.

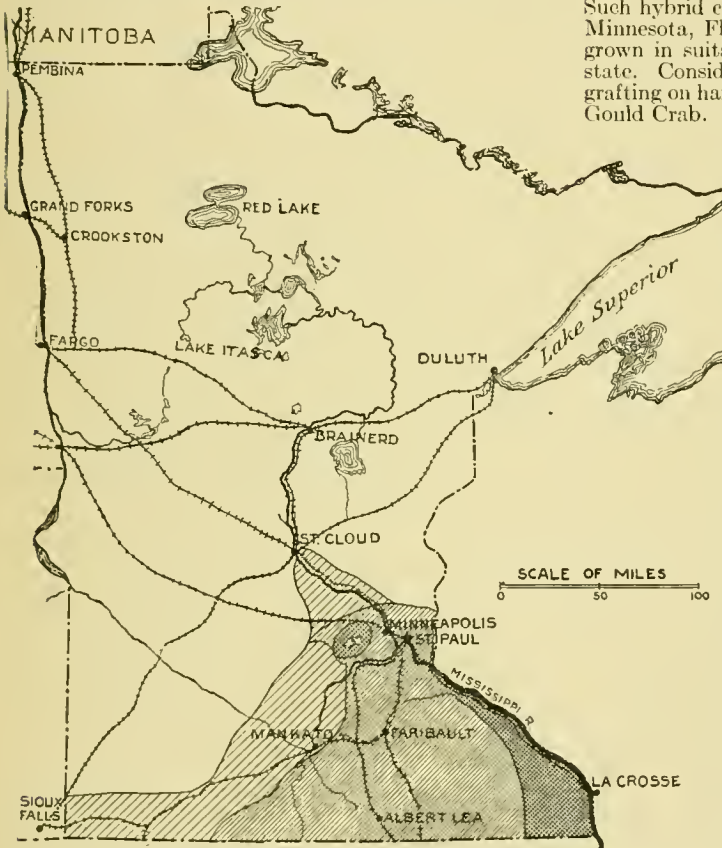
The americana class of plums is found growing wild all over the state, and the fruit is gathered in large quantities. The cultivated sorts of this class are easily grown everywhere. Wild plums can generally be obtained in abundance in autumn at about \$1.50 a bushel. There is no variety of any other class of plums that is appreciably cultivated, although in very favorable locations a few of the Japan and domestic sorts are grown.

Cherries may be successfully grown on a large scale in extreme southeastern Minnesota, and there are some commercial orchards there, but generally throughout the state the fruit-buds are so injured in winter that the trees are unproductive, although they may make a very satisfactory tree growth.

Pears usually blight to death early, and there is no variety that is generally cultivated. Several of the Russian pears are as hardy as the Duchess apple, but they have died, so far as they have been tried, from blight before becoming very productive. Apricots are not sufficiently hardy.

The most common injury to trees is known as sun-scald of the trunks, which often causes severe loss. It is easily avoided by shading the trunks. Blight seriously injures some varieties of apples. Winter-protection of various kinds is important and carefully attended to by the best horticulturists.

Vegetables of all the kinds grown in the northern states are very easily raised, and the display of these products in the large markets is excellent. Cabbage, cauliflower, celery, peas, lettuce, potatoes, beans, corn, cucumbers, tomatoes, squash, watermelons, muskmelons and eggplant are to be had in abundance, and the markets are often glutted with them. Native muskmelons and tomatoes occasionally retail at 10 to 15 cents a bushel. The canning of vegetables is becoming an important industry at several points. The climate seems to be especially favorable to vegetables, and there



2501. Minnesota, showing the best developed horticultural parts.

state. Most of the well-known cultivated sorts of the five species first named do well under cultivation, and large quantities are raised for home consumption and are profitably marketed. The Concord, Worden, Delaware, and grapes of similar character, are easily raised in the many good locations along the lake shores and the river bluffs, and this is an important industry, notwithstanding the fact that the grapes have to be covered in winter, which adds somewhat to the expense of culture. However, on account of the peculiar adaptability of the Delaware grape to some of the soils and to the climate, it is raised with profit in competition with the growers of the eastern states, though the Concord is not high enough in price by one cent a pound to permit of this to any great extent.

Apples are raised on a commercial scale in southern and eastern Minnesota, the high, rolling land in the southeastern part being especially well adapted to their

is much less trouble from disease than in many more humid sections. There are two vegetable-growers' associations in the state. The Minneapolis and St. Paul associations, which have a membership of over 200, have been very instrumental in getting a more uniform and better grade of produce on the market. While they do not attempt to set the price of produce, they have proved of much value to the trucking interests both in raising and marketing produce.

One of the important crops of the state is potatoes. These are grown quite largely in the Red River Valley and in the section of country north and northeast of Minneapolis nearly to Duluth. Large quantities are shipped South and West for seed purposes. Special potato organizations have taken hold of the work and are building an important business.

The growing of vegetables under glass has increased greatly in the past few years. Lettuce, tomatoes, and cucumbers are the principal crops grown under glass, although mint, cress, radishes, and parsley are grown to some extent, and find a ready market. A number of larger growers have installed irrigation systems in their greenhouses and find them very satisfactory. They are also used to some extent for outdoor crops. Probably \$800,000 to \$1,000,000 is invested in the business.

Mushrooms for market are grown to a considerable extent about the Twin Cities. One of the largest pure-culture mushroom-spawn plants in the country is located in St. Paul. This same plant grows large quantities of mushrooms for market.

There are something over 100 nurseries in Minnesota, totaling about 3,000 acres of land and ranging in size from an acre or less to 250 or 300 acres of actual nursery stock. Large importations of bulbs and plants are made from Europe and from outside the state each year. Up to the present time, much of the nursery stock except fruit has been propagated outside the state. With the advent of more greenhouses in connection with the business, much more stock is now propagated at home. Nearly all nurseries doing a large business have established landscape-gardening departments to handle their increasing work along ornamental lines. A number of nurseries have been established specializing only in ornamental shrubs, peonies, iris and perennials.

The demand for ornamental horticulture is considerable and rapidly increasing, giving investment to at least \$1,000,000 in the greenhouse business, besides large quantities of flowers and plants purchased outside the state and sold through retail flower-stores. Carnations, violets and chrysanthemums are grown in large quantities. A limited amount of sweet peas, snapdragons, and the like, are also grown and easily disposed of. Large quantities of bulbs, such as tulips, narcissi, and Easter lilies, are forced principally for Christmas and Easter. Roses and some other flowers are brought in from growers outside of the state to a considerable extent, although there are a number of large growers in the state. Peonies, dahlias, asters, sweet peas and iris are grown in large quantities outside for cut-flowers. The demand for these has developed a number of specialists who supply the very best class of material. Minneapolis and St. Paul each have strong florist associations.

The love for horticulture is also shown by the immense sums spent by the cities and small towns for public parks. Minneapolis alone has 3,800 acres of city parks, 50 miles of drives and 1,305 acres of lake surface. St. Paul, Duluth, and other cities and towns of the state will easily bring the park acreage up to 8,000 or 10,000 acres. Besides this, there are three or four state parks, containing something over 1,000 acres, and about 44,000 acres of forest reserve, a part of which is used as a natural public park or playground. These parks are visited by several millions of persons each year, and undoubtedly exert much influence.

Public-service agencies for horticulture.

The University of Minnesota is at Minneapolis, and in 1869 the Department of Agriculture was established at St. Anthony Park about 3 miles from the main campus. Here are located the Experiment Station, School of Agriculture, and College of Agriculture. Although the Agricultural Department was established in 1869, it was not of much importance until about 1885, when a part of the present farm was purchased and the first School of Agriculture established in 1889. There are sub-stations at Crookston, Morris, Grand Rapids, Waseca, and Duluth. A trial fruit station is maintained at Owatonna. This was originally used for raising apple seedlings, but this work has now been taken over by the Fruit Breeding Farm at Excelsior and the Owatonna Station is used only as a trial station.

Schools of agriculture are maintained at Crookston and Morris, in which horticulture is taught to some extent. Horticulture is taught in most of the high-schools in the state having agricultural courses. School-gardens and nature-study classes in some form or other are to be found in nearly all schools.

The Extension Division of the Agricultural Department has a horticulturist who holds institutes, short course lectures, and demonstrations in horticulture throughout the state. Members of the regular Station staff aid in this work to some extent.

Several hundred farmers' clubs scattered throughout the state are aiding in the spread of better agricultural methods. Many of these clubs have special horticultural programs and committees and study horticultural problems systematically.

The Minnesota State Horticultural Society is a very strong and popular organization. Great interest is taken in the raising of seedling apples, and at some of the state fair meetings more than 300 separate varieties of Minnesota origin have been shown. A number of years ago \$1,000 was offered for a seedling winter apple, especially adapted to Minnesota conditions. No one has yet been able to claim the prize. One hundred dollars is offered as a prize for a seedling plum of certain qualities, and about \$1,000 in prizes are offered for the encouragement of apple-growing. The Society has some eight or ten trial stations operated in different parts of the state at which new fruits, flowers, and so on, are tested. Through the reports of the superintendents of these stations, a fair index of the value of a plant for general use may be obtained. There are a number of local horticultural societies in the state besides a state florist society, which affiliate with the State Horticultural Society. There are also two or three vegetable associations.

The legislature of 1907 appropriated \$16,000 for buying land for a fruit-breeding farm. Near Excelsior, 77.89 acres were purchased and equipped with greenhouse, house, storage-cellar, barn and other buildings. Large numbers of seedling strawberries, plums, raspberries and apples are being grown there. The seedling apples are just beginning to fruit, but very promising seedling plums, strawberries and raspberries have already been produced and are distributed over the state. Excellent results have been obtained and its usefulness is just beginning. Nearly the whole acreage is now in seedling fruits bred at this farm.

Statistics (Thirteenth Census).

In 1910 the approximate land area of Minnesota was 51,749,120 acres. The land in farms was 27,675,823 acres, or 53.5 per cent of the land area. Of the land in farms 19,613,533 acres were improved; 3,922,391 acres were in woodland; and 4,109,899 acres were unimproved. The number of all the farms in the state in 1910 was 156,137. The average acreage to a farm was 177.3. [The total area of the state of Minnesota is 84,682 square miles.]

The leading agricultural crops are cereals, hay and forage, and forest products of the farms. In 1909, 51.6 per cent of the improved land, or 10,139,850 acres were occupied by cereals and the valuation of the production was \$140,864,148, which was 72.8 per cent of the total value of all the crops. The acreage of hay and forage increased from 3,157,690 in 1899 to 3,946,072 in 1909, an increase of 25 per cent, when the production was valued at \$26,724,801, or 13.8 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was \$5,181,508, as compared with \$2,602,335 in 1899. In 1909 flaxseed was produced to the amount of 3,277,238 bushels, valued at \$4,863,328.

The horticultural crops produced were fruits and nuts, small-fruits, vegetables including potatoes, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$813,971, as compared with \$125,240 in 1899. Small-fruits increased in acreage from 3,092 in 1899 to 3,738 in 1909, when the production was 4,476,575 quarts, valued at \$493,406. In 1909 the total acreage of potatoes and other vegetables was 269,713 and their value \$11,044,391. Excluding potatoes, the acreage of the other vegetables was 46,021, and their value \$3,359,052, both acreage and value being materially greater than in 1899. Flowers and plants and nursery products increased in acreage from 1,270 in 1899 to 4,017 in 1909, when the value of their products was \$1,466,949.

The total quantity of orchard fruits produced in 1909 was 1,066,659 bushels, valued at \$801,112. Apples contributed 97.9 per cent of this quantity, and plums and prunes most of the remainder. The apple trees of bearing age in 1910 numbered 1,380,396; those not of bearing age, 1,571,816. The production in 1909 was 1,044,156 bushels, valued at \$769,114. The plum and prune trees of bearing age in 1910 numbered 233,736; those not of bearing age, 167,926. The production was 19,920 bushels, valued at \$27,808. Other orchard-fruits produced in 1909 were 1,526 bushels of cherries, valued at \$2,973; 559 bushels of peaches and nectarines, valued at \$659; 400 bushels of pears, valued at \$465; and apricots, quinces and mulberries in minor quantities.

Grapes were produced to the amount of 293,805 pounds in 1909, valued at \$11,021. In 1899 the production of grapes was 573,272 pounds. The number of vines of bearing age in 1910 was 61,916; those not of bearing age, 35,950.

The nut industry is not an important one in Minnesota, the total production in 1909 being \$1,555 pounds, valued at \$1,838. The most important of the nuts is the black walnut which produced in 1909, 65,074 pounds, valued at \$1,490. Other nuts which are growing in Minnesota in very limited quantities are the butternuts, hickory-nuts, chestnuts and others of more or less importance.

Of the small-fruits grown in Minnesota, strawberries are by far the most important, with the different raspberries ranking next. The acreage of strawberries increased from 1,302 in 1899 to 1,873 in 1909, when the production was 2,730,099 quarts, valued at \$268,772. The acreage of raspberries and loganberries increased from 1,115 in 1899 to 1,388 in 1909, when the production was 1,340,469 quarts, valued at \$178,689. Other small-fruits produced in 1909 were 182,825 quarts of currants, valued at \$19,783; 139,741 quarts of blackberries and dewberries, valued at \$17,696; 60,661 quarts of gooseberries, valued at \$6,412; and 22,112 quarts of cranberries, valued at \$1,981.

Of the vegetables, potatoes far exceed any of the others. The acreage of potatoes increased from 146,659 in 1899 to 223,692 in 1909, when the production was 26,802,948 bushels, valued at \$7,685,259. The more important of the other vegetables produced were 1,099 acres of onions, valued at \$182,069; 2,315 acres of cabbage, valued at \$128,430; 4,697 acres of dry edible beans, valued at \$124,996; 2,829 acres of sweet corn,

valued at \$62,387; 1,190 acres of cucumbers, valued at \$59,512; 499 acres of tomatoes, valued at \$52,631, and 453 acres of cantaloupes and muskmelons, valued at \$41,913. Vegetables of minor importance were asparagus, green beans, beets, carrots, cauliflower, celery, pop-corn, lettuce, green peas, radishes, rhubarb, squash and watermelons.

The acreage devoted to flowers and plants increased from 143 in 1899 to 163 in 1909, an increase of 14 per cent. The total area under glass in 1909 was 1,419,196 square feet, of which 1,332,758 were covered by greenhouses, and 86,438 by sashes and frames. The value of flowers and plants produced in 1909 was \$603,935, as compared with \$288,055 in 1899.

The acreage occupied by nursery products in Minnesota increased from 1,127 in 1899 to 3,854 in 1909, an increase of 242 per cent. The value of the nursery products in 1909 was \$863,014, as compared with \$383,105 in 1899.

LEROY CADY.

Iowa.

Iowa (Fig. 2502) is nearly a rectangle, about 200 miles north and south between the parallels 40° 36' and 43° 30', and 300 miles east and west, bordered on the east by the Mississippi and on the west by the Missouri and Big Sioux rivers. Its extreme elevations are 444 feet in the southeast corner and 1,694 feet at the highest point near the northwest corner, the average elevation being about 800 feet above the sea. The annual rainfall, coming largely from the moist airs of the Gulf, varies with the altitude; in the southeast corner, 37 inches and in the northwest corner, 27.37 inches, at Des Moines, 32.66 inches, which last is nearly the average for the state. The annual temperature is 51° in the southeast, 44° in the northwest and 40° at Des Moines, also about the average of the whole state. The surface is a gently undulating grassy plain, well drained by numerous streams flowing into the rivers at its borders. All these streams are bordered more or less broadly with belts of native timber, often many miles in width along the lower parts of the larger ones. The divide between the streams flowing eastwardly and those flowing westwardly is a line running from a little east of the northwest corner, southwardly to about the middle of the state at the south line, draining three-fourths of the state into the Mississippi and one-fourth westwardly. The entire surface, except a short and narrow belt along the Mississippi at the northeast corner, is deeply covered with glacial drift, the depth varying from a few feet to 200 feet or more. In about half the state this drift is overlaid more or less deeply with a peculiar deposit called loess, this being mainly in the south and extending north on the west side, and in a narrower belt on the east, to the north line of the state. There are no other regions the size of Iowa which contain fewer acres unfit for agriculture; which is as profitable in the northern as in the southern part.

Horticulture is, however, profoundly affected by a region of glacial drift which, coming in from the north, occupies much more than half of the state; embracing that part of Iowa lying north of a line drawn from about latitude 42.5° (Sioux City) on the west, to 41.5° (Des Moines) in the central part, thence to the northeast corner of the state, latitude about 43.5°. In this new drift soil, fruit-growing is much more difficult than in the loess regions above mentioned. During the past few years, however, artificial drainage in this region has been rapidly developed, making it one of the richest agricultural sections in the Union and greatly increasing the range of horticultural possibilities. There, while statistics are still unavailable, are found the greatest development of the americana (native) plums, strawberries, gooseberries and currants, in this state, with splendid home market. Hardy varieties of

apples and grapes, hybrid plums, raspberries, and blackberries are being successfully planted, though not yet in sufficient quantity to supply the local demand.

The most favorable regions for the apple are found in the southwest and southeast along the Missouri, Mississippi and Des Moines rivers, where the so-called "bluff deposits" have their greatest development. This is a light-colored, porous soil which endures drought and flood, and is especially friendly to the apple, the cherry, and the grape, and, in fact, all fruits of the region. The leading varieties of apples in the older commercial orchards are Jonathan, Grimes, Ben Davis, Gano, Winesap and Black Twig, probably ranking in value according to the order named. Of late, Delicious, Stayman, and Ingram have been very freely planted in the southern part; while in the north, Wealthy, Malinda, and Northwestern Greening are most prominent. Spraying is generally carried on in

The culture of the peach, domestica and Japanese plums does not reach north much beyond latitude 41.5°, though it is pushing steadily northward by the adoption of newly introduced seedling varieties. The peach is developing considerable commercial importance in the extreme southern part, while the domestica and Japanese plums are decreasing in favor owing to the lack of hardiness and strong tendency to rot.

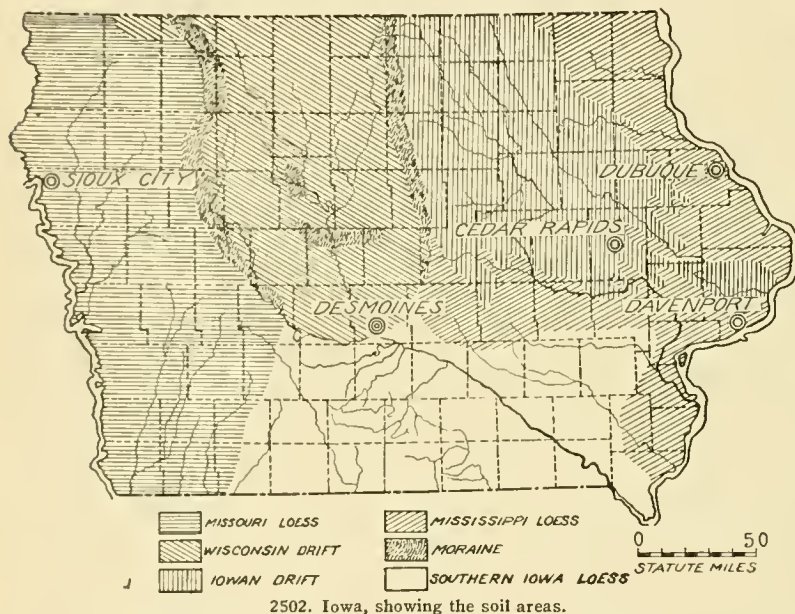
Pears, while rather freely planted throughout the loess soil sections of the state, have become commercially prominent only in a few limited areas, notably the bluffs along the river south of Des Moines and near the eastern border from Davenport southward. The largest individual pear orchard at present includes over 100 acres, owned by B. A. Matthews, of Knoxville, largely Kieffer, from which eight to fifteen carloads are shipped annually. Generally, however, the soil is found too heavy for successful pear-culture; only the thin-soiled bluffs and hillsides can be recommended for pear orchards, and these must be seeded down and sometimes root-pruned to prevent disastrous blight.

Practically all parts of the state can produce good grapes, though the centers of commercial vineyards are largely confined to the regions surrounding Council Bluffs on the west and Des Moines in the central part. Concord, Moore Early and Worden comprise fully 90 per cent of the planting, the Concord proving most reliable, Moore Early generally most profitable an acre.

Next to sour cherry and hybrid plums, the most rapid advancement is now being made in the planting of the blackcap raspberries. About fifteen years ago, thousands of acres were devoted to this fruit throughout the south central belt of the state, but low prices, due to an undeveloped market and the general spread of the anthracnose fungus disease, discouraged fruit-

growers. Plantations destroyed by the disease were not replanted, causing a decided decrease in raspberry-production. Prices have since been going steadily upward until now with prospect of netting from \$200 to \$350 an acre annually with favorable seasons and good care, rather extensive planting is again resumed. On account of the excellent outlet to the north for surplus fruit, besides a splendid home market, it is likely that Des Moines will remain the principal raspberry center. Cumberland first, with Gregg a close second, and Kansas for early fruit, constitute the bulk of the planting. Shallow cultivation and summer mulch to protect against drought at harvest time, bring best results.

The fruits which have been and are likely to remain most prominent commercially over the state are the apple, the cherry, grapes, strawberries, and raspberries. Almost without exception, the perishable fruits are grown in greatest volume near the large market centers of the state, the only prominent exception being in the case of cherries and grapes extensively grown for annual shipment to northern and northwestern markets, extending into Minnesota and the Dakotas. The three principal centers of commercial cherry- and grape-culture are: (1) along the Missouri River, on the west, from Sioux City down to the Missouri line; (2) along the Mississippi and some of its Iowa tributaries, from Davenport southward; and (3) in the vicinity of Des



the larger centers but clean tillage in the older orchards is rather the exception than the rule.

The sour cherry occupies second place in Iowa fruits and promises most rapid development. Especially successful wherever the loess soil is found, it does not reach commercial importance beyond latitude 42.5° (Sioux City and Dubuque) on the west and east of the state, the line of success dropping about 1° of latitude southwardly in the center of the state, where the newer drift has overlaid the loess. By reason of the failure of cherry in the northern half of the state, there is a splendid market, practically inexhaustible, at good margin, for all surplus cherries grown in the southern half. Early Richmond is by far the most valuable, with Montmorency second and English Morello third. Sweet cherries do not succeed.

The plum, while of considerable annual value, is not strictly a commercial fruit of Iowa. Being the native home of a large number of pure americana varieties, this class of course finds its greatest development within the state, especially the northern part. Of these, Terry, De Soto, Wyant, Hawkeye, Wolf and Hammer remain most prominent, with Wild Goose leading the Chickasaw or narrow-leaf type. The many fine hybrid plums promise to bring Iowa forward as one of the principal plum-growing sections of the Middle West.

Moines. Small-fruits, figured on the basis of actual consumption and based on an average for the state, will probably exceed in value all the tree-fruits combined, the small-fruits being limited to no particular area but successfully grown for home use and local market in all parts of the state.

The Atlantic seaboard, with its 200 years of seedling orchard production before budding and root-grafting became common practice, was enabled through necessity, by seedling selection, to develop its "apple kings" and other fruits, all specially adapted, by reason of such seedling selection, to the soil and climate of the region. The first surprise and disappointment came to the early settlers of Iowa when they discovered that the fruits, so desirable and profitable in the East, either winter-killed or proved quite barren in this region. The later introduction of pure Russian fruits under the auspices of a misguided state official, proved a complete failure with few exceptions. The shock horticulture received from these two experiences retarded the development of the pomology of the state. The introduction of budding and root-grafting by nurserymen in propagating all fruit-trees terminated compulsory seedling selection. Gradually, as the needs of this great inland prairie region of hot dry summers and fierce changeable winters were realized, enthusiastic and devoted breeders have been at work with the result that Iowa and her sister states are now experiencing a far greater degree of practical pomological development than any other region in the western hemisphere.

The rich soils and abundant rains during the growing season invite the extensive development of market-gardening. The fast-growing cities, the gradual westward trend of manufacturing, and the numerous canneries scattered over the state, offer a splendid and constantly increasing market. Heretofore the first impulse of practically every agriculturist was to devote himself wholly to corn, grain and live-stock, and it has been only in these limited areas where general agriculture could not be pursued with most satisfactory results, that commercial fruit-growing and market-gardening received deserved attention. Gradually, with the steady increase of land values, demanding more intensive farming, and the dissemination of the knowledge that one must conserve and husband the resources of the soil, fruit and vegetables are becoming more generally developed. The best fruit sections of the state are those most prominent in market-gardening because land values are the highest and modern economical methods have proved the need of constant cultivation leading to intercrops of vegetables of highest market values. The most important vegetable is the potato, successfully grown on new land in all parts of the state. Sweet corn is grown in small quantities in all sections to supply abundantly home needs and local markets, while in the vicinity of canning-plants, most numerous in the central and northern part of the state, many thousand acres are devoted to this product. Generally, beans, peas, and tomatoes are also grown rather extensively in the vicinity of the canneries. Onion-, celery- and watermelon-culture are advancing in importance, being rather general over the state in a limited way, though reaching a stage of considerable importance along the eastern border, centralizing in the vicinity of Muscatine along the Mississippi River.

The nursery business has had large development in the state of Iowa. At Shenandoah, near the southwest corner of the state, are two of the largest wholesale nurseries found in the West. Other important nurseries are carried on at Des Moines, Charles City and other places, while small establishments are found in almost every county.

Public-service agencies for horticulture.

The land-grant college in Iowa and the Iowa Experiment Station are located together at Ames and

work in close harmony. At present there are eleven men on the horticultural staff of the College engaged in instruction work. The pomology section has one sub-station in connection with a leased orchard at Council Bluffs, where problems in orchard and soil management are especially studied. The number of horticultural bulletins is at present eight, all published within the last ten years.

The State College at Ames is the only school giving special instruction in horticulture. The State Teachers College at Cedar Falls gives horticultural work in connection with agriculture, but no special course in horticulture. At present, horticulture is taught in over 150 high-schools of the state. Beginning with the fall of 1915, similar instruction will be furnished in some 800 schools of the state, in compliance with a law lately enacted.

The State Horticultural Society receives from the state \$4,000 annually for its use. It holds its annual meeting in December of each year and prints a report of its own proceedings, as well as of its four subordinate district societies.

The extension work in horticulture is handled through the division of agricultural extension of the Iowa State College. At the present time there are three men on the extension staff in pomology and truck crops. The work of these men is supplemented by the assistance of other members of the college and experiment station staffs and consists of farm institutes, short courses, orchard and garden demonstrations, farm tours, and so on.

The inspection service in Iowa is handled through the office of the State Entomologist and applies strictly only to injurious insects, though the nurserymen, in cooperation with the State Entomologist, have maintained inspection for injurious diseases.

A very important work not connected with state institutions has been conducted by C. G. Patten, assisted by support from the State Horticultural Society, the state and the general government. There are about 20 acres near Charles City thickly planted with cross-bred and selected stock, chiefly of apples, pears, plums and cherries, with more or less of many other kinds of fruits and plants. A number of apples originated at this experiment station have entered into general use in large sections. There has also originated at this station a new race of pears by crossing the Chinese sand pear with American sorts of better flavor. Several generations of trees are growing which are entirely hardy and blight-proof in the extreme north of the state, so that there is promise of plenty of good pears in the near future in the orchards of Iowa.

Statistics (Thirteenth Census).

The approximate land area is 35,575,040 acres. The land in farms is 95.4 per cent of the land area, or 33,930,688 acres. Of the land in farms 86.9 per cent, or 29,491,199 acres, are improved; 2,314,115 acres are in woodland; and 2,125,374 acres are classified as unimproved land in farms. The number of all the farms in the state in 1909 was 217,044, there being 156.3 acres in the average farm. [The area of Iowa is 56,147 square miles.]

The leading agricultural crops are the cereals and hay and forage. In 1909 the acreage devoted to cereals was 15,041,039, or 51 per cent of the improved land. The value of the cereal products for the same year was \$230,205,315, which was 73.2 per cent of the total value of all crops. The acreage devoted to hay and forage was 5,046,185 in 1909 and the value of the products \$59,360,225, which was 18.9 per cent of the total value of all crops. Sugar crops were raised to the extent of 7,276 acres, the production being valued at \$208,283. The value of the forest products of the farms in 1909 was \$3,649,032, which was 1.2 per cent of the total value of all crops.

Horticultural crops grown are fruits and nuts, small-fruits, vegetables, including potatoes, and flowers and

plants and nursery products. The value of the fruits and nuts produced in 1909 was \$4,650,875, as compared with \$2,023,730, their value in 1899. The acreage devoted to vegetables, including potatoes and sweet potatoes and yams, was, in 1909, 252,243 and their value \$12,021,408, thus making vegetables by far the most important of the horticultural crops grown in Iowa. Small-fruits decreased in acreage from 9,635 in 1899 to 7,211 in 1909, when the value of their products was \$966,894. As an industry, the growing of flowers and plants and nursery products was of more importance than that of small-fruits. The value of flowers and plants and nursery products in 1909 was \$1,503,305 as compared with \$939,499, their value in 1899.

The total production of orchard-fruits in Iowa in 1909 was 7,234,168 bushels, valued at \$4,283,873. Apples, the most important of the orchard-fruits, produced 6,746,668 bushels alone, which was more than nine-tenths of the total production. The value of the apples produced in 1909 was \$3,550,729. Cherries, the next orchard fruit of importance, produced 260,432 bushels, valued at \$455,022. The production of plums and prunes in 1909 was 158,036 bushels, valued at \$192,421; that of pears, 44,449 bushels, valued at \$58,777; that of peaches and nectarines 23,180 bushels, valued at \$24,950. In addition, apricots were produced to the value of \$942; quinces to the value of \$681; and mulberries, to the value of \$351.

The production of grapes for 1909 was 11,708,336 pounds, valued at \$330,078. The number of grapevines of bearing age in 1910 was 1,983,465; those not of bearing age, 446,126.

The production of nuts in 1909 was 1,721,265 pounds, valued at \$36,922. Most of the nuts were black walnuts and hickory-nuts. In 1909 the black walnuts produced 1,134,061 pounds, valued at \$20,589, and the hickory-nuts, 539,203 pounds, valued at \$15,251. Butternuts were produced to the amount of 37,931 pounds, valued at \$758.

Strawberries are by far the most important of the small-fruits grown in Iowa, with blackberries and dewberries, and raspberries and loganberries ranking next. The acreage devoted to strawberries increased from 2,335 in 1899 to 2,917 in 1909, when the production was 5,330,105 quarts, valued at \$479,511. The acreage of blackberries and dewberries increased during the same period from 1,719 in 1899 to 2,279 in 1909 when the production was 2,733,728 quarts, valued at \$247,734. Raspberries and loganberries decreased in acreage from 3,394 in 1899 to 1,573 in 1909. In 1909 the production was 1,728,547 quarts, valued at \$191,037. The same year the production of currants was 317,637 quarts, valued at \$27,315; and that of gooseberries 233,544 quarts, valued at \$21,251.

Of the vegetables, the potato is by far the most important. In 1909, 169,567 acres devoted to potatoes produced 14,710,247 bushels, valued at \$6,629,234, more than half the value of all vegetables produced. Among the leading vegetables, other than potatoes, their acreage, and the value of the products were: sweet corn, 12,568 acres, valued at \$219,220; cabbage, 2,789 acres, valued at \$148,529; pop-corn, 5,345 acres, valued at \$135,270; sweet potatoes and yams, 2,274 acres, valued at \$125,763; onions, 849 acres, valued at \$118,155; watermelons, 3,464 acres, valued at \$112,217; and tomatoes, 2,055 acres, valued at \$100,457. Other vegetables grown in Iowa in 1909 were asparagus, green beans, cantaloupes and muskmelons, celery, cucumbers, lettuce, green peas, radishes, and turnips.

The acreage devoted to the production of flowers and plants increased from 140 in 1899 to 361 in 1909, an increase of 157.9 per cent. The total area under glass in 1909 was 2,183,182 square feet, of which 1,870,845 were covered by greenhouses and 312,337 by sashes and frames. The value of the flowers and plants pro-

duced in 1909 was \$657,393, as compared with \$320,407, their value in 1899.

The acreage occupied by establishments producing nursery products was 3,430 in 1909, as compared with 2,905, the acreage in 1899, an increase of 18.1 per cent. The value of the nursery products in 1909 was \$845,912, as compared with \$619,092, the value in 1899.

C. L. WATROUS.

Missouri.

Its central position gives Missouri (Fig. 2503) a medium climate, favorable to the growth of a variety of horticultural products. The cosmopolitan character of its plants is indicated by the native flora. Northern, southern, eastern and western species blend and overlap here. The wild crab of the prairie states and the juneberries, capable of enduring the rigors of a northern winter, flourish here in the same forest with the more southern persimmon and the pawpaw. The northern grapes of the *Labrusca* type, like Concord, are among the standard varieties, while on the other hand tender varieties like Herbemont and the tender hybrids usually winter safely. The riparia group is native to the state, while the more tender *Vitis rotundifolia* of the Gulf region reaches splendid natural development in the southeastern part of the state. While the berries and small-fruits common to the northern states endure well the warmer climate of Missouri, the oriental persimmon, English walnut and *Poncirus* (*Citrus*) *trifoliata* are hardy in the southern part. The northern plum (*Prunus americana*) extends south into Missouri where it mingles in the same woodlands with the southern Chickasaw plum (*P. angustifolia*). These two have hybridized in nature, and some of these hybrids have found an important place in our list of cultivated American plums.

Missouri's central position is also favorable to the marketing of her fruit. Perishable fruits, such as berries and peaches, are shipped to nearly all of the principal markets east of the Rocky Mountains, from Boston and Baltimore on the east, Omaha, Denver and Pueblo on the west, and from St. Paul and Detroit on the north to Mobile, New Orleans and Galveston on the south. Some of the grain-raising, mining and grazing states of the west and northwest, where but little fruit is produced, furnish a growing market for Missouri fruit. The Mississippi and Missouri rivers, with their tributaries, touching the entire length and breadth of the state, furnish cheap freight rates north, south, and northwest, and direct railroad connections with the Gulf ports afford cheap shipment of apples to European markets.

The following figures give the average monthly rainfall in inches as recorded at Columbia by the United States Weather Bureau: January, 1.89; February, 2.57; March, 2.97; April, 4.52; May, 5.87; June, 4.56; July, 4.85; August, 2.81; September, 3.60; October, 1.40; November, 2.87 and December, 2.02. While these figures show the rainfall is ample (approximately 40 inches annually) and well distributed throughout the year, the records also show the percentage of sunny days in this immediate section is high. During August, September and October, especially, when most of the fruit is maturing, the average amount of bright sunlight is considerably higher than that of most of the orchard states. No doubt the intense sunlight and the proximity to the prairies are important factors in producing the rich color and high flavor of Missouri fruit, and may also account, in part at least, for its comparative freedom from many of the fungous diseases which are known to thrive best in a moist cloudy atmosphere.

The topography and soil of the state are both favorable to fruit-growing. The undulating areas, intersected by the Mississippi and Missouri rivers and their tributaries, are amply provided with both soil and atmospheric drainage. The more important fruit-soils include the deep, rich, loess formation (see Fig. 2503)

forming the hills and tablelands overlooking the two great rivers of the state. Wherever this loess occurs, the world over, it is recognized as a typical fruit soil. The light, deep, brownish red clay loam of the Ozark uplift, containing sufficient sand and broken rock to afford excellent drainage, is also an important fruit-soil. The extensive swamp region in the southeastern part of the state is now being drained by the dredging of an extensive ditch system and is bringing under cultivation a large area of the very richest soil. This is becoming one of the most important vegetable-producing sections of the state. The growing of watermelons especially has already reached important development. Blodgett is said to be the largest watermelon shipping point in the United States. The higher second bottom-lands of the two great river-systems are also splendidly adapted to the production of orchards and of truck-crops.

The census for 1900 credited Missouri with over 20,000,000 apple trees in her orchards. This was 33½ per cent more than were reported for any other state.



Something over 8,000,000 were reported in 1890, showing an increase of over 12,000,000 apples trees in a single decade. This was a larger number of apple trees planted in a single decade in Missouri than were growing in the year 1900 in any other states, except three. This enormous activity in apple-orchard development resulted in putting out some of the largest orchards in the world. Some of the Missouri orchards contain upward of 2,000 acres, a considerable number are of more than 1,000 acres in extent, and orchards of several hundred acres each are quite usual in almost any of the orchard districts of Missouri. This enormous planting in so short a period and largely in newly developed regions has resulted in some of the plantings going out on soil which has since proved to be unadapted to the industry. Many of the larger orchards put out in newly developed regions where insects and diseases had not had opportunity to get a foothold produced profitable crops early, but are too large to receive the care necessary to protect them from insects and fungous diseases which follow closely upon the march of orchard development. For that reason, some of the larger orchards of the state have perhaps not been so profitable as was expected. On the other hand, this extensive pioneer work in orcharding has been the means of shaping profitable orcharding of today. It has helped to map the successful orchard areas in contrast to those soils less adapted to the industry. It has shown the adaptation of varieties to the state and the local adaptation of

special varieties to the various districts within the state. As a result, the conservative orchardist of today is profiting by the experience of the pioneers whose extensive efforts gave to the state the sobriquet of "The Land of the Big Red Apple."

The present status of orcharding in the state rests upon a sound commercial basis. The grower knows the adaptability of the different soil formations and of the various varieties. The present trend is toward the planting of moderate-sized orchards to the varieties which have been proved to be most profitable for the neighborhood, and to the adoption of modern methods of pruning, spraying, packing and marketing of fruit, which is resulting in substantial profit.

The state has a large and growing nursery interest. The loess soil along the two great rivers and the richer soils of the Ozark region produce especially fine nursery stock. At Louisiana is located one of the pioneer nurseries of the Mississippi Valley, which is now said to be the largest nursery enterprise in the world.

The Ozark section and river hills produce exceptionally fine yields and quality of tomatoes for canning purposes. Canning factories prosper in various parts of the state, the tomato being the leading product canned.

The southwest section of the state is a notable strawberry-producing region; Searsville, Pierce City, Monett and other towns adjacent are leading strawberry shipping points. Some of these towns ship several hundred carloads annually.

About Canton, St. Joseph, and other points, extensive pickle-producing interests have developed. The production of cucumbers and other pickle-producing plants is becoming a growing industry. In the north-western section of the state large quantities of cucumbers are grown for seed. About St. Louis and vicinity, the production of horse-radish is extensively developed. In St. Louis and Carroll counties, the production of early potatoes for July shipment has reached a prosperous development, and early potato-growing is rapidly taking its place in the agriculture of the state.

The floriculture interests of the state are large and increasing. St. Louis and Kansas City have extensive greenhouse enterprises, not only for local market, but for shipment. At Lee's Summit is one of the largest greenhouse plants in the country. Even in some of the smaller cities, the production of flowers under glass is in many cases more than supplying the local demand. Roses, carnations, violets, bulbous plants, and bedding plants are the leading crops, but many firms do a very general business in plant-production. The region is especially favorable for winter greenhouse work. The proportion of sunny days is unusually high as compared with other sections of the country in which floriculture has reached important proportions. Winter temperatures are not severe. The light snow and comparative freedom from ice obviates the difficulty experienced in many other sections.

Along the Missouri River hills are developed in the loess soil formation numerous grape- and wine-producing centers. Herman particularly possesses very extensive wine-cellars.

Within the past fifty years a notable number of varieties of fruit have originated within the borders of the state. It is interesting to note that while up to thirty years ago the varieties recommended by the state were mostly of Atlantic coast or European origin, the present list of commercial varieties very largely originated either in Missouri or adjacent territory. Some of these have been distinct additions in the way of local adaptation—for instance, the Ingram apple originated at Springfield, is the latest-blooming sort grown commercially in the state, escaping late spring frosts, and is perhaps the most important commercial variety for the southern and western slopes of the Ozarks. The amelioration of our native species of grapes has taken

the attention of many prominent Missouri horticulturists. In this connection should be mentioned the work of Engelmann in the classification of the grape and the work in grape-breeding by Judge Miller, Jacob Rommel, Herman Jaeger and many others, including the contributions of Dr. Stayman, whose initial work began in Missouri. This state will be remembered as the home of the Soulard crab, and seedlings of this hybrid are now being grown which promise to bring its stock to an important place in our cultivated varieties.

While horticulture is already one of the leading interests of Missouri the possibilities of the state in that direction have not yet been even approximated. While many of our pioneer orchards were located on soils and sites not well adapted to fruit, still only a small proportion of the soil which has been proved beyond a doubt to be splendidly adapted to profitable orcharding and berry-growing has as yet been cultivated. In recent years, however, steps in advance are rapidly being taken. The best growers are planting varieties of the finer types of dessert fruit, instead of clinging to the commercial varieties of mediocre quality which first made the state famous as an apple section. For the most part, men who are making money out of their orchards and fruit plantations today are those with smaller areas well cared for and whose enterprise has not come to notice outside the state. New varieties better adapted to local conditions are being originated. Our native fruits and nuts are receiving attention and improved varieties of these are already the result. One of the problems confronting the early orchardist was the fact of our comparatively mild but changeable winters. Northern varieties were often forced into early bloom before danger of spring frosts was over. Varieties like the Ingram apple mentioned above are now being introduced which possess a more persistent rest period and escape spring frosts. The horticulture of the state is rapidly rounding into a stable condition and bids fair to reach very important proportions.

Public-service agencies for horticulture.

The College of Agriculture was established in 1870, as a department of the State University at Columbia. Of the agricultural college staff five members devote their time to giving instruction in horticulture. In addition two or three special assistants, usually advanced students, are employed during the summer to conduct orchard demonstrations in spraying, pruning, harvesting, packing, and so on, in the various fruit-growing districts of the state.

The Experiment Station is also located at Columbia as a department of the State University. Four members of its staff devote their time to horticultural problems. Between forty-five and fifty horticultural bulletins have been published, giving the results of investigation work to date (1915). In addition a large number of circulars and press bulletins have been sent out.

The Missouri Fruit Experiment Station is located at Mountain Grove. It was established by legislative enactment in 1899. The working staff consists of a director and horticulturist, a pathologist and an entomologist. This institution is rendering splendid service to the horticultural interests of the state by conducting demonstration work in spraying, pruning and other phases of orchard-management in the fruit centers and also through investigation work which is being done at the station.

The Missouri Botanical Garden, located in St. Louis and richly endowed by the will of the late Henry Shaw, maintains a school for training students in horticulture. Five state normal schools, located at Cape Girardeau, Kirksville, Maryville, Springfield and Warrensburg respectively, give teachers courses in agriculture and horticulture. Lincoln Institute, a state school for

negroes, located at Jefferson City, gives instruction in agriculture and horticulture.

The State Department of Education and the public schools early took a leading part in introducing the study of agriculture and of horticulture. The teaching of agriculture and horticulture is required in all the rural schools of the state. Legislative enactment provides state aid for high-schools which maintain specified equipment, grounds and courses of study in agriculture and horticulture. At present (1915) there are about 450 high-schools in the state which are fulfilling this requirement for state aid.

The Missouri State Horticultural Society, established in 1859, has held annual meetings for a period of more than fifty years. Fruit exhibits as well as papers and addresses by leading horticultural talent are a feature of these meetings.

The State Board of Horticulture was established by the state legislature in 1907 to promote the interests of fruit-growing in Missouri. In 1913 the Board published a census of all the commercial orchards of the state.

Several of the above agencies conduct extension work in horticulture. The Missouri Fruit Experiment Station conducts practical demonstrations. The department of horticulture at the State University gives extension instruction in horticulture through extension short courses. In coöperation with the county superintendents of schools, the University conducts boys' and girls' contests in such work as tomato-growing and potato-growing.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 43,985,280 acres. The land in farms was 34,591,248 acres, or 78.6 per cent of the land area. Of the land in farms 24,581,186 acres were improved; 8,918,972 acres were in woodland; and 1,091,090 acres were other unimproved land in farms. The total number of farms in 1910 was 277,244. The average acreage a farm was 124.8. [The total area of Missouri is 69,420 square miles.]

The leading agricultural crops of Missouri are cereals, hay and forage, with cotton and sugar crops secondary in importance. The acreage of cereals was 10,423,745 in 1899 and 10,255,476 in 1909, when the value of the products was \$147,980,414, which was 67.1 per cent of the total value of all crops. Hay and forage increased in acreage from 3,481,506 in 1899 to 3,628,348 in 1909, when the value of the products was \$33,845,094. Cotton increased in acreage from 45,596 in 1899 to 96,527 in 1909, an increase of 111.7 per cent, when the value of the production was \$3,978,295. Sugar crops increased in acreage from 30,997 in 1899 to 45,268 in 1909, when the production was valued at \$1,039,168. The value of the forest products of farms was \$8,406,823 in 1909, as compared with \$4,442,131, their value in 1899.

Horticultural crops grown in Missouri are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$7,111,279, as compared with \$3,278,840 in 1899. The acreage of small-fruits increased from 14,860 in 1899 to 17,009 in 1909, when the production was 23,696,221 quarts, valued at \$1,761,409. In 1909, the total acreage of potatoes and other vegetables was 233,767 and their value \$13,305,829. Excluding potatoes and sweet potatoes and yams, the acreage of vegetables was 129,570, and their value \$8,268,281, the acreage and value being an increase of 11.5 per cent and 49.1 per cent, respectively, over the acreage and value in 1899. The acreage devoted to flowers and plants and nursery products decreased from 3,152 in 1899 to 2,842 in 1909, when the value of the products was \$1,183,297.

The total production of orchard fruits in 1909 was 11,957,339 bushels, valued at \$6,582,578. Apples contributed about five-sixths of this production, and

peaches and nectarines most of the remainder, the production of apples being 9,968,977 bushels, valued at \$4,885,544; and that of peaches and nectarines 1,484,548 bushels, valued at \$1,110,550. The number of apple trees of bearing age in 1910 was 14,359,673; those not of bearing age 3,624,833; peach and nectarine trees of bearing age in 1910 numbered 6,588,034; those not of bearing age, 1,401,429. Other orchard-fruits produced in 1909 were: 123,314 bushels of cherries, valued at \$222,510; 142,547 bushels of pears, valued at \$148,789; 234,872 bushels of plums and prunes, valued at \$211,472; and minor quantities of apricots, quinces, and mulberries.

In 1909, 17,871,816 pounds of grapes were produced, valued at \$488,755. The grape-vines of bearing age in 1910 numbered 3,026,526; those not of bearing age 486,044.

The total production of nuts in 1909 was 2,823,368 pounds, valued at \$39,746. The greater quantity of these were produced by black walnuts, the production in 1909 being 2,446,402 pounds, valued at \$24,526. Pecans, next in importance, produced 147,420 pounds, valued at \$10,467; hickory-nuts produced 210,228 pounds, valued at \$3,633; and Persian or English walnuts, 5,791 pounds, valued at \$618.

Strawberries are by far the most important of the small-fruits grown in Missouri, with blackberries and dewberries second in importance. The acreage of strawberries increased from 7,498 in 1899 to 9,048 in 1909, when the production was 15,171,034 quarts, valued at \$1,122,784. The acreage of blackberries and dewberries increased from 4,441 acres in 1899 to 5,975 in 1909, when the production was 6,391,209 quarts, valued at \$456,283. The production of raspberries and loganberries was 1,563,527 quarts, valued at \$133,196; that of gooseberries, 470,029 quarts, valued at \$39,941; that of currants, 91,207 quarts, valued at \$8,312; and that of cranberries, 6,944 quarts, valued at \$618.

The acreage devoted to the growing of potatoes in Missouri increased from 93,915 in 1899 to 96,259 in 1909, when the production was 7,796,410 bushels, valued at \$4,470,135. The acreage devoted to the sweet potato and yam was 7,938, in 1909, a decrease of 19.4 per cent from the acreage in 1899. The production in 1909 was 876,234 bushels, valued at \$567,413. The more important of the other vegetables were: 11,083 acres of tomatoes, valued at \$322,426; 10,727 acres of watermelons, valued at \$258,940; 2,858 acres of sweet corn, valued at \$80,928; 959 acres of cabbage, valued at \$79,707; 1,701 acres of cantaloupes and muskmelons, valued at \$65,380; and 374 acres of horse-radish, valued at \$62,694. Vegetables of minor importance produced in 1909 were asparagus, green beans, beets, cauliflower, celery, popcorn, cucumbers, lettuce, onions, green peas, green peppers, radishes, rhubarb and turnips.

The acreage devoted to the production of flowers and plants increased from 181 in 1899 to 383 in 1909, an increase of 111.6 per cent. The total area under glass was, in 1909, 2,812,221 square feet, of which 2,545,138 were covered by greenhouses and 267,083 by sashes and frames. The value of the flowers and plants produced in 1909 was \$653,903.

The acreage devoted to nursery products, however, decreased from 2,971 in 1899 to 2,459 in 1909, when the value of the products was \$529,394, as compared with \$349,449 in 1899.

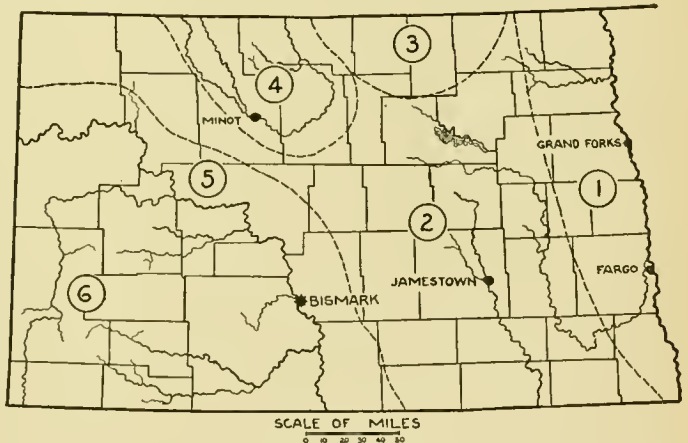
J. C. WHITTEN.

North Dakota.

North Dakota (Fig. 2504) lies between latitude 46° and 49° north, and longitude 96° 25' and 104° west. The special advantages of soil and climate for the produc-

tion of grass and the small grains have given the state great agricultural prominence, but little has been done along horticultural lines. While it possesses undoubted possibilities along certain lines of fruit-production, and in the growing of certain vegetables can hardly be excelled, yet these things have always been considered incidental and not to be classed with the leading soil industries. North Dakota settlers, for the most part, did not come from fruit regions, and in no case have they occupied the land with other intention than to raise stock and grain. At the same time, as population increases and homes become established, there is the natural tendency to protect these homes with trees, ornament them with shrubs and flowers, and furnish the table with vegetables and fruit.

The distinctive regions of North Dakota are referred to as Red River Valley (Section 1), the Turtle Mountain country (3), the Devil's Lake region (2), the Mouse River country (4), the James River Valley (2), the Missouri slope (5) and the western range country (6), including the Bad Lands. The Red River Valley is a level plain from 20 to 30 miles wide on the North Dakota side and extending across the state north and south, thus embracing an uninterrupted area of some 6,000 square miles, all level and of great fertility. This is preëminently the wheat-belt of the state, and the character of the soil is such in both physical and chemical properties as to insure an excellent growth of such plants as are hardy and will mature within the season. The soil is a lacustrine deposit containing about 33 per cent of very fine sand, 55 per cent clay and silt, and 12 per cent organic matter and soluble salts. It is so rich in nitrogen and phosphoric acid as to be quite indifferent to fertilizers, even when applied to such garden



2504. North Dakota, with the six areas.

vegetables as demand the most fertile soils. It rarely bakes under reasonable cultivation, is never lumpy and is very retentive of moisture. It is unusually well adapted to the cultivation of practically all vegetables, particularly celery and other plants requiring a deep, fine, easily worked soil.

This general type of soil is not confined to the Red River Valley, but is the predominating surface soil for most of the state lying east of meridian 101 and of considerable tracts still farther west. The subsoil in the Red River Valley lying under 3 or 4 feet of very dark loam is uniformly a soft yellowish clay extending to a great depth. Much of the subsoil outside of the valley is largely made up of firmly compacted sand, with a small percentage of clay. Such lands are not so good as those having the clay subsoil, but with the good surface soil which they support they are capable of producing large yields in seasons not too dry. They are

naturally not so well adapted to horticultural operations as are the lands having the clay subsoil.

Speaking in general, the soil lying west of the 100th parallel, also that of the Missouri slope, Turtle Mountain and Mouse River counties is all well suited to vegetable- and fruit-culture, though partial failure may result from short seasons. This is especially true upon the level, rich soil of the Red River Valley, which tends to prolong the growth of such plants as the grape and apple beyond the season in which they should mature. The more rolling surface of the land along the Missouri River affords opportunity to select favorable sites for fruit plantations, and there is doubtless some advantage in the soil itself. This is apparent in the cultivation of the grape, or such vegetables as the tomato, squash and melon. So far, attempts to grow fruit on the lighter and more rolling soils, avoiding the extremes, has met with reasonable success. On the heavier soils and level lands, success has been confined to the cultivation of such small-fruits as the currant, gooseberry, raspberry and American plum, and vegetables maturing not later than the earliest sorts of tomato or second-early sweet corn. In connection with the fact that attempts at apple-culture have generally been unsuccessful, it should be remembered that plants, as a rule, cannot make long jumps. The line of apple-culture is gradually moving northwest, the successful varieties being those, like the Wealthy and Patten Greening, that have originated in the newer places. A region so far removed from the apple districts as North Dakota must have time and opportunity to develop varieties of its own.

Removed from all influence of large bodies of water, North Dakota has a comparatively dry climate subject to considerable extremes of temperature. The mean annual rainfall at Fargo for the years 1892 to 1909 was 21.25 inches, distributed by seasons nearly as follows: spring, 6 inches; summer, 10.5 inches; fall, 3.75 inches; winter 1 inch. Most of the precipitation is in spring and summer, when it is most needed. The average rainfall for June is 4.17 inches. The fact that the larger part of agricultural lands in the state are absolutely flat, as near as land may be, and composed of a soil very retentive of moisture, makes what would otherwise be a light rainfall generally sufficient for ordinary needs. Farther west than Fargo, the rainfall gradually becomes less.

The temperature is very uniform throughout the state, with the general difference that the range country in the western part has milder and more open winters, and the higher altitude, as well as latitude, of the northern tier of counties gives them a shorter and cooler summer, more inclined to frosts. It is only in that section that corn has not been considered, so far, as a possible crop.

The winters are cold but dry and agreeable. An occasional winter with too much sunshine kills young trees of the thin-barked varieties through the process of desiccation. The springs are short, the warm days of summer coming very soon after winter and some time before the frost is out of the ground. In summer the days are long and sunny, with nights invariably cool. This condition gives the most perfect development of hardy vegetables, like the cabbage and celery, but retards the cucurbits and other semi-tropical species.

General settlement of what is now North Dakota did not begin till the building of the first railroad in 1873, and any effort to grow fruit has been made since that time. In 1874, Andrew McHench, of Fargo, made the first attempt at fruit-growing upon any extended scale. In that year he bought at a nursery in Minneapolis a carload of young apple and crab-apple trees of such varieties as the Wealthy, Hyslop and Transcendent, and the year following planted 7,500 root-grafts of these and other varieties. Though he obtained some fruit and at different times grew trees that were models

of thrift and fruitfulness, yet the venture was not a success. The varieties that successfully resisted the cold winters succumbed to the blight shortly after they came into bearing. Other attempts by different men made along the Red River Valley since then have resulted similarly. In more recent years, with the elimination of the Transcendent which is especially subject to blight, efforts at apple-growing have been more successful. This has been especially true in the regions of the lighter soils in the southern part of the state. At Cogswell, Hankinson, Lisbon, and Edgeley, there are good bearing orchards of such varieties as the Hibernial, Duchess, Wealthy, Patten's Greening and Iowa Beauty. Any of the crabs are successfully grown, eliminating only those subject to blight. In many other parts of the state, younger orchards are coming on that promise as well as those already mentioned.

The only other tree-fruit hardy in North Dakota is the native plum (*Prunus americana*) and some of its hybrids. Of the pure species there are many varieties that are productive and suitable for home use and local markets but too soft for shipping. The De Soto, Surprise, Weaver, Wolf and Hawkeye, are among the varieties more commonly grown. The hybrids resulting from crosses between the American plum and the sand cherry and also between the American plum and the Japanese plum are all hardy and productive in North Dakota and many of them promise to be of value commercially as well as for home use.

Most commercial varieties of grapes find the seasons too short or the winters too cold, though the Moore Early can be grown in the southern part of the state. The Beta grape is being successfully grown in many parts of the state.

Currants and gooseberries find a congenial soil and climate in all parts of the state and the hardier varieties of raspberries do well when planted near a windbreak so that they will remain covered with snow.

Early attempts at strawberry-growing, before the days of windbreaks, were not very successful. As shelter has been provided and more vigorous varieties have been introduced, the strawberry is being commonly grown for home use. The introduction of the Senator Dunlap was the beginning of successful strawberry-growing in North Dakota.

There are but few vegetables that cannot be produced abundantly and cheaply. This is particularly true of celery, onions, parsnips, and the like, that require a deep, mellow soil. The earlier sorts of sweet corn and tomatoes can be successfully grown in most sections of the state. At the Experiment Station at Fargo, a yield of 1,000 bushels of ripe tomatoes has been secured in some seasons on 1 acre. The ease with which the soil is worked and the fact that no fertilizer is required reduces the cost of production to a minimum.

The horticultural progress of the state since 1900 has been due largely to the development of the nursery industry. This in the early settlement of the state consisted simply of the collection and sale of young seedling trees. These were gathered in great numbers from along the bed of the Missouri River, whose soft banks, always flooded in the spring, especially favored the germination of tree seeds. The cottonwood was the one most usually selected, although the box elder and ash were gathered to some extent. Most of the older groves in the state are from these Missouri River seedlings, the total number planted running into the millions. The supply of forest trees, as well as other nursery stock, is now furnished by the nurseries, of which there are four of considerable size and a number of smaller ones of more recent origin. One of these has devoted its attention largely to the growing of conifers and as a result has a fine stock of many thousands of such hardy species as the jack pine, western yellow pine, Douglas spruce, Black Hills spruce and Colorado blue spruce. At the present time, nursery sales consist

chiefly of rapidly growing trees for shelter and wind-break purposes. The common white willow and its variety, the golden Russian willow, the laurel-leaf willow and a variety of the cottonwood, commercially known as Norway poplar, are the trees in greatest demand. The native ash and the box elder are also bought freely. The trade in fruit-trees and ornamentals is considerably less and is still largely furnished by outside nurseries. However, some of the local nurseries have blocks of hardy varieties of apples and plums running into thousands with business increasing rapidly.

Within the past ten years a few floral establishments have been built up in the larger towns and in all cases have met with marked commercial success. While none of them has over 50,000 square feet under glass, yet with the quality of stock produced and the high prices readily obtained the business is decidedly profitable. The growers claim a certain advantage in the bright, clear weather of autumn that gives them carnations and chrysanthemums of unsurpassed color and quality. The same applies to roses, except during December and January, when the short days do not furnish enough hours of daylight for the best results.

While the wild fruits occupy an inconsiderable part of the total area of the state, yet they are important in that they furnish thousands of families with their yearly supply of jellies and other fruit products. A list of the wild fruits in order of their importance would be about as follows: plum, buffalo berry (*Shepherdia argentea*), cherry (*Prunus demissa*), grape (*Vitis vulpina*) and juneberry (*Amelanchier alnifolia*). The red raspberry and strawberry are also found sparingly. The only plum in the state is *Prunus americana*, and this is found wherever other trees or shrubs grow. It is strongly variable in almost every character except fruitfulness, all forms being decidedly prolific. The fruit generally is of good quality, sweet and rich when ripe, but too soft to keep well. In a domestic way, wild plum jelly is recognized as a staple article of superior merit, and though the plums are abundant in most seasons, yet they readily bring \$2 a bushel in the local markets. The improved strains of this plum, like the DeSoto, Weaver and Surprise, are being introduced and successfully cultivated. The buffalo berry is found from the James River westward, growing in thickets along streams and coulees. The bright red acid fruit is borne in the greatest profusion, but is rather difficult to gather, as it is sessile and thorns are plenty. It makes a clear jelly of reddish amber-color and delicate flavor. *Prunus pumila* is widely scattered but not abundant, and the fruit is used but little. In the western part of the state the juneberry produces abundantly a large fruit of rich flavor, but is more often used fresh from the bushes than in a culinary way. The rapid settling of the state has increased the demand for native fruits to such an extent that their value is being appreciated, and private ownership even in wild fruits is being insisted upon and recognized. This, of course, leads directly to the development and preservation of the better strains.

Among those influential in developing fruit-growing in North Dakota were Andrew McIlhench of Fargo and Col. R. H. Hankinson, of Hankinson.

Public-service agencies for horticulture.

The land-grant college of North Dakota was established at Fargo in 1890. There are three members of the horticultural staff.

The Experiment Station is also located at Fargo. There are two horticulturists on the staff. Several regular bulletins and also press bulletins have been issued on horticultural subjects. Within the last twelve years, there have been established from time to time five sub-experiment stations in the different parts of the state, where trials are being made to a limited extent with trees and fruits. At most of these stations,

more or less encouraging results with both tree- and small-fruits have been obtained, and in some cases the yield has been such as to indicate commercial success, particularly with the Patten Greening apple and some of the varieties of the American plum.

In addition to these state experiment stations, there was established at Mandan, in 1912, a federal station known as the Northern Great Plains Experiment Station. One of the prominent objects of this station is to carry on trials with horticultural plants of all classes, and to develop fruits suited to the Great Plains region.

There are two special schools in the state teaching horticulture, the School of Forestry at Bottineau and the State Normal School at Valley City. Two terms of horticulture are also taught in most of the high schools.

The nursery inspection is conducted by the state.

Statistics (Thirteenth Census).

The approximate land area of North Dakota is 44,917,120 acres. The land in farms in 1910 was 63.3 per cent of the land area or 28,426,650 acres. Of this land in farms, the improved land numbered 20,445,092 acres; the woodland, 421,877 acres; and other unimproved land in farms 7,549,681 acres. The total number of farms of the state in 1910 was 74,360 and the average acreage to the farm was 382.3. [The total area of the state is 70,837 square miles.]

The leading agricultural crops produced in the state are cereals, flaxseed, and hay and forage. The acreage of cereals increased from 5,610,374 in 1899 to 11,887,141 in 1909, when the production was valued at \$149,133,451, which was 82.6 per cent of the total value of all crops. Flaxseed increased in acreage from 773,999 in 1899 to 1,068,049 in 1909, when the production was 10,245,684 bushels, valued at \$15,488,016. Hay and forage increased in acreage from 1,410,534 in 1899 to 2,864,218 in 1909, when the production was valued at \$12,368,014. The forest products of the farms in 1909 were valued at \$235,386, as compared with \$112,807, in 1899.

Horticultural crops grown in North Dakota are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$9,702, as compared with \$1,177 in 1899. Small-fruits increased in acreage from 67 in 1899 to 399 in 1909, when the production was 285,696 quarts, valued at \$39,641. In 1909 the total acreage of potatoes and other vegetables was 67,450 and their value \$3,148,304. Excluding potatoes, the acreage of other vegetables increased from 4,289 in 1899 to 13,383 in 1909, when the production was valued at \$1,069,125. Flowers and plants and nursery products increased in acreage from 133 in 1899 to 476 in 1909, when the products were valued at \$78,218.

The total quantity of orchard fruits produced in 1909 was 5,685 bushels, valued at \$9,688, while that of grapes and nuts was entirely insignificant. The apple trees of bearing age in 1910 numbered 15,941; those not of bearing age 70,023, and the production in 1909 was 4,374 bushels, valued at \$7,270. The plum and prune trees of bearing age in 1910 were 19,147; those not of bearing age 35,459, and the production in 1909 was 1,048 bushels, valued at \$1,866. The cherry trees of bearing age in 1910 numbered 5,076; those not of bearing age, 21,484. The production in 1909 was 209 bushels, valued at \$445. The production of peaches and nectarines, pears, apricots, and quinces was insignificant.

Currants are the most important of the small-fruits raised in North Dakota. The acreage of currants increased from 36 in 1899 to 138 in 1909, when the production was 97,598 quarts, valued at \$12,128. Strawberries increased in acreage from 3 in 1899 to 88 in 1909, when the production was 66,028 quarts, valued at \$10,445. Raspberries and loganberries increased in acreage from 12 in 1899 to 85 in 1909, when the produc-

tion was 60,742 quarts, valued at \$9,141. Gooseberries increased in acreage from 10 in 1899 to 86 in 1909, when the production was 56,801 quarts, valued at \$7,332. Other small-fruits produced in 1909 were 3,404 quarts of blackberries and dewberries, valued at \$470, and 1,120 quarts of cranberries, valued at \$125.

The acreage devoted to potatoes increased from 21,936 in 1899 to 54,067 in 1909, when the production was 5,551,430 bushels, valued at \$2,079,125. The more important of the other vegetables produced were: 37 acres of onions, valued at \$9,188; 109 acres of cabbage, valued at \$8,724; 96 acres of watermelons, valued at \$3,719; 144 acres of sweet corn, valued at \$3,369; 88 acres of turnips, valued at \$3,145; and 7 acres of celery, valued at \$1,680. Vegetables of lesser importance, produced in 1909, were asparagus, green beans, carrots, cucumbers, green peas, and tomatoes.

There were 4 acres devoted to the production of flowers and plants in 1909 and the products valued at \$47,221. The total area under glass in 1909 was 70,670 square feet, of which 48,150 were covered by greenhouses and 22,520 by sashes and frames. The area devoted to nursery products in North Dakota increased from 131 acres in 1899 to 472 in 1909, when the products were valued at \$30,997.

C. B. WALDRON.

South Dakota.

South Dakota (Fig. 2505) lies a little north of the center of the continent, between latitude 45° 57' north, and 42° 28' south and longitude 96° 26' and 104° 3' west of Greenwich. Its shape is approximately a



rectangle. Its extreme length from east to west is 386 miles; extreme breadth north to south 240 miles; population (in 1910) 583,888. The Missouri River divides the state into two nearly equal portions. With the exception of a small area in the northeast corner, the southeast part is lowest and all the streams flow in that direction. The state may be divided into three sections: (1) the Black Hills; (2) the Tablelands; (3) the Eastern Section. The Black Hills in the southwestern part are outliers of the Rocky Mountains, and the extensive and very rich deposits of gold, silver, and other minerals are important sources of wealth. The Indians early knew of these gold deposits, but they were not known to white men until 1874. The Black Hills, so named by the Indians because of the heavy forests of pine and spruce covering the mountains, include an area of about 5,000 square miles. Considerable fruit is now being raised in this section under irrigation, as the local market is a profitable one, and it has been found

possible to raise many varieties not hardy upon the open prairies of the state.

The Tablelands comprise the entire section of the state west of the Missouri River, with the exception of the Black Hills. Five branches of the Missouri flow from the western part of the state across these lands from west to east. These are the White, Bad, Cheyenne, Moreau or Owl, and Grand rivers. The series of dry years 1910-11-12-13 show that exclusive grain-farming is not advisable, but the native grasses are very nutritious and stock-raising is profitable.

The Eastern Section contains three river valleys that cross it from north to south, viz., the eastern half of the Missouri, the James River Valley and the Big Sioux River on the eastern border. In the southern part, the valley of the Vermillion traverses the region between the Sioux and James. These river valleys are all very fertile and blend together as they reach the Missouri at the south. Diversified agriculture flourishes in these river valleys, especially in the southern and entire eastern part of this section. In the higher ground in the northern and western part, stock-raising and dairying are the main industries owing to the lesser rainfall. Since the defining of the artesian-well basin, general agriculture has been encroaching upon the grazing areas. This basin reaches from the Missouri River eastward to some distance beyond the James. The amount of this supply which can be used has been roughly estimated at 326,805,600,000 cubic feet annually, an amount of water sufficient to fill a riverbed a mile wide, 20 feet deep and nearly 600 miles long. When this water is more generally utilized, it is confidently believed that the market-gardening and fruit-growing area shown on the map will be enlarged and extended westward.

Horticulture in South Dakota is to a considerable extent still in the experimental stage. Most of the planting of orchard-fruits has been done since the last "crucial test" winter of 1884-5, hence it will be difficult to give a safe list until after the next test winter. A glance at the map will show that the state extends well below the north line of Iowa, and as a matter of fact, it is found that the South Dakota fruit list partakes of both Iowa and Minnesota in its characteristics. The southern tier of counties in the southeast corner of the state can raise varieties of the apple which are not at all hardy northward in the state. It is interesting to trace the orcharding belt along the great river from far down in Missouri northward between Iowa and Nebraska into South Dakota. In the Sioux and James river valleys considerable fruit is grown as far north as the Minnesota line. North of

this the orchards are few and far between, the country being new, and grain-raising, stock-raising and dairying affording more profitable sources of income.

The state has been divided into four fruit sections by the State Horticultural Society since 1913, as follows: Northern District—this includes all north of a line running due east and west through Watertown; Central District—this district includes approximately all between two lines running due east and west through Sioux Falls and Watertown; Southern District—this includes all south of the north line of Iowa, which is approximately a line running due east and west through Sioux Falls; the Black Hills District—this includes the Black Hills counties in the southwestern corner of the state.

The largest old apple orchard in the state is in Turner County, consisting of 7,000 trees on about 132 acres. This orchard was planted in the early seventies and is still bearing. About 4,000 of the trees are

Wealthy and most of the remainder Oldenburg. Considerable trouble is experienced from root-killing of the common apple seedling stocks. In the northern part of the state, apple root-grafts root-kill every winter unless deeply mulched. The winter of 1898-9 will long be remembered as the "root-killing" winter by the fruit men of several northwestern states. Efforts are now being made to remedy this trouble by testing the Russian method of preventing root-killing; viz., the use of the pure Siberian crab (*Pyrus baccata*) as a stock. If the experiments are successful, apple-culture will be practicable on the most exposed prairies far up into the Canadian Northwest. In making up a list of apples for planting throughout the state, it will be a safe rule not to plant any variety less hardy than Oldenburg and Wealthy, especially if the planter desires a long-lived fruitful orchard and cannot afford to experiment.

Of plums, those of the *Prunus americana* type, such as De Soto, Wyant, Wolf, Terry and Wastesa, are the standard of hardiness and value for general cultivation. *Prunus americana* is indigenous throughout the state. In recent years, the list of plums has been largely increased by the advent of the hybrids of the native sand cherry and plum with the Japanese plum and Chinese apricot, *Prunus Simonii*, originated at the South Dakota Experiment Station. The main difficulty with plums hitherto has been the tender stocks upon which the hardy natives have been worked. Myrobolan, St. Julian, Marianna, Southern Chickasaw, peach, and other southern stocks all winter-kill, leaving the hardy top to die. Such trees are a snare to the prairie planter, and this fact is becoming more generally known. Trees worked on americana seedlings or trees on their own roots find favor, as no trouble is then experienced from root-killing. The western sand cherry (*Prunus Besseyi*), a native of the state, has been tested as a stock at the Experiment Station at Brookings, but it is of use only as a dwarf stock for amateur use, the trees being dwarfed and bearing fruit at an early age. It is of some promise as a dwarf stock for peaches, such trees being of suitable size for convenient covering in winter or for growing in boxes.

Of other orchard-fruits, pears, quinces, apricots and peaches find no place on the South Dakota fruit list. Cherries are grown to a small extent in the southern counties, but the crop is uncertain in most parts.

Some raspberries can be grown in the southern part with winter protection. Blackberries are not so hardy as raspberries. Strawberries are considerably grown in the southern part of the state, and irrigation is found profitable, as it insures a crop in dry seasons.

Grapes are grown to some extent in the southern part of the state, but northward suffer severely from winter-killing and are not on the fruit list recommended for that part of the state. The Beta, a hybrid of the wild grape, *Vitis riparia* (*vulpina*), of Carver County, Minnesota, with the Concord (*V. Labrusca*), was originated about 1870 by the late Louis Suelter, of Minnesota, and has been found to be much harder than those of the Concord type and is now largely planted. It appears perfectly hardy without winter protection.

Fruit-breeding at the South Dakota Experiment Station has been carried on under the direction of the Department of Horticulture since 1895. Much work has been done in the breeding of hardy fruits. The frequent winter-killing of varieties brought from milder regions east and south seems to demand the creation of a new prairie pomology. Over 27,000 seedlings of various native fruits were raised at this station in 1889-1890. The wild fruits were crossed with tame whenever possible, but the main reliance was placed upon pure selection, acting upon the theory that "excess of food causes variation." The native species taken in hand in this work include the sand cherry, choke-cherry, pin-cherry, black currant, golden currant, gooseberry,

grape, juneberry, plum, red raspberry, black raspberry, strawberry. With the apple, the main effort is to originate a good hardy long-keeping winter apple. Work with several Siberian fruits is also under way. Some of this material was picked up on tours of agricultural exploration to Siberia and adjacent regions. In this work, hundreds of thousands of seedlings have been discarded. Some have not proved amenable to improvement, such as the wild black currant, *Ribes floridum*, which has reached the fifth generation under cultivation without improvement in quality. The same may be said of the native gooseberry, *Ribes gracile*. Fully 100,000 seedlings of the native sand cherry, *Prunus Besseyi*, native especially of the dry uplands of the western part of the state, have been fruited, but only three varieties have been named, the Sioux, Tomahawk, and Champa, with fruit of good size and free from the native astringency. In five plant generations under cultivation, the fruit has been increased to 1 inch in diameter and of good quality. However, the plant is too small in stature, and propagation by budding is expensive; some are being raised by layering. However, the sand cherry displays marked adaptability to hybridization with many species. (See South Dakota Experiment Station Bulletins Nos. 108, 130, and 159.) When mated with the Japanese plum, a series of valuable hybrids have resulted, but hybrids with the peach and the sweet cherry and apricot of Europe are practically sterile. Mating with the purple-leaved plum of Persia, *Prunus cerasifera purpurea*, gives a beautiful purple-leaved shrub. The native plum, *Prunus americana*, is found to mate best with the Japanese plum, the latest result of which is the Waneta, with fruit 2 inches in diameter and weighing two ounces. The native plum is found to mate well with the sand-cherry, giving such hybrids as Sansoto and Cheresoto. The native plum mates best with the Chinese apricot, *Prunus Simonii*, giving fruits with remarkable shipping capacity and with the strong fragrance of the *Prunus Simonii*. Over 10,000 plum seedlings have been raised. The work with the native seedlings was checked with the advent of the hybrids which were found sufficiently hardy. Easily 1,000,000 trees of these new plums are now in the orchards and nurseries of the western states.

After raising 10,000 apple seedlings, none has been introduced with the exception of one crab-apple, the Amur, a seedling of *Pyrus baccata cerasifera*, introduced 1912.

In strawberries, the main work has been to combine the wild types as found in the Dakotas and the Canadian Northwest and Alaska with the standard American varieties and those imported from Europe. Out of 10,000 seedlings but two have been named, the South Dakota No. 1 and No. 2. The fruit is about 1 inch in diameter; the plants are hardy without winter-covering, but must be kept thinned, otherwise the fruit runs too small, as is the case of the wild strawberry from which they sprang.

Out of 13,000 raspberry seedlings, only two, the Sunbeam and Ohta, have been named and introduced. Improvement by pure selection of the wild raspberries of the Dakotas and the Canadian Northwest is slow work, but is not yet given up. The Sunbeam, introduced in 1906, is the first of the 7,000 first seedlings to receive a name. It is a seedling of the wild red raspberry from Cavalier County, North Dakota, near the Manitoba line, pollinated by the Shaffer. From the next 6,000 seedlings came the Ohta, introduced spring of 1912, which is a seedling of the wild red raspberry from Cavalier County, North Dakota, pollinated by Minnetonka Ironclad, a hybrid of the wild raspberry from Maple Plain, Minnesota, with either Turner or Cuthbert.

Pear-culture is at present a practical impossibility either from winter-killing, or from blight (*Bacillus amylovorus*). The work of breeding pears immune to

blight is summarized in South Dakota Experiment Station Bulletin No. 159, April, 1915.

An effort has been made to improve the wild prairie rose of the Canadian Northwest, and the Siberian form of *Rosa rugosa*. Out of many seedlings, only one variety, the Tetonkaha, has been disseminated.

Floriculture is still in its early youth, there being but few greenhouses in the state. The rich soil makes it easy to raise large crops of vegetables, but so far, the trucking interests have assumed no importance, except near the larger towns. Agriculture has been extensive, rather than intensive. In a state yielding heavy crops of wheat and other cereals, with a soil so rich that commercial fertilizers are not thought of and barnyard manure so little considered that many farmers prefer to move their barns rather than their manure heaps, and with the burning of straw a common practice, the hoe is rarely seen; gang- and sulky-plows, self-binders and riding-cultivators are the more favored implements. In the course of time, with the increase in population, will come a change in methods. Eastern farmers and gardeners find that the soil and climate demand decided modifications of eastern practices.

Of conifers, the hemlock, white pine, balsam fir, arbor-vitae and Norway spruce fail in the open prairie, while Jack pine, bull pine, Scotch pine, northern red cedar, western white spruce, and Colorado silver or blue spruce all do well in open exposure. Of deciduous trees, the native species, such as ash, elm, box elder, black wild cherry and hackberry, all do well. Cottonwood and willows do well on moist land. Considerable loss was experienced in the earlier planting from a failure to recognize the fact that species covering a wide geographical range vary greatly in hardiness and that the local indigenous form should be planted when possible.

Many of the hardy pioneer men and women have contributed to the horticultural interests of South Dakota. Among these may be mentioned: Aaron Carpenter, pioneer orchardist and nurseryman; H. C. Warner, who tested many fruits, trees and flowers; Col. C. W. Gurney, pomologist and nurseryman; and A. W. Krueger, for five years president of the State Horticultural Society.

Public-service agencies for horticulture.

The South Dakota College of Agriculture and Mechanic Arts is located at Brookings, and was established in 1881. There is one professor of horticulture.

The Experiment Station is also at Brookings and is in connection with the College. Of the 159 bulletins published by the Station (June, 1915), forty are on horticultural subjects.

The only special school teaching horticulture in the state is the College. However, some horticulture is taught in connection with agriculture in the public schools.

The South Dakota State Horticultural Society is composed of the amateur and professional fruitmen of the state, and was incorporated in 1890. By state law, this Society is made the Department of Horticulture for South Dakota.

Extension work in horticulture is conducted by the College in the form of farmers' institutes and the like.

No inspection service is provided for in fruit-grading. The Department of Entomology of the State College has charge of the inspection service for nurseries.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 49,195,520 acres. The land in farms was 52.9 per cent of the land area, or 26,016,892 acres. Of this land in farms, the improved land numbered 15,827,208 acres, the woodland 383,144 acres, and other unimproved land in farms 9,806,540 acres. The total number of farms in 1910 was 77,644, and the average acreage a farm was

335.1. [The total area of South Dakota is 77,615 square miles.]

The leading agricultural crops of South Dakota are cereals and hay and forage. The acreage devoted to the cereals increased from 6,241,223 in 1899 to 8,203,519 in 1909, when the production was valued at \$98,953,050, which was 78.8 per cent of the total value of all crops. Hay and forage increased in acreage from 2,287,875 in 1899 to 3,435,656 in 1909, when the production was valued at \$15,243,661. In 1909, from 518,566 acres, there were harvested 4,759,794 bushels of flaxseed, valued at \$7,001,717. The value of the forest products of the farms in 1909 was \$257,126, as compared with \$106,284 in 1899.

Horticultural crops grown in South Dakota are fruits and nuts, small-fruits, potatoes and vegetables, and flowers, plants, and nursery products. The value of the fruits and nuts produced in 1909 was \$215,639, as compared with \$31,964, in 1899. Small-fruits increased in acreage from 161 in 1899 to 419 in 1909, when the production was 401,295 quarts, valued at \$47,263. The total acreage of potatoes and other vegetables in 1909 was 65,209, and their value, \$3,001,574. Excluding potatoes, the acreage of other vegetables increased from 7,954 in 1899 to 15,150 in 1909, when the production was valued at \$1,033,163. Flowers, plants, and nursery products increased in acreage from 211 in 1899 to 418 in 1909, when the value of the production was \$120,835.

The total quantity of orchard fruits produced in 1909 was 229,907 bushels, valued at \$209,339. Apples contributed about five-sixths of this quantity, plums and prunes most of the remainder. The production of apples in 1909 was 191,784 bushels, valued at \$158,729. The number of apple trees of bearing age in 1910 numbered 274,862; those not of bearing age, 460,547. The plum and prune trees of bearing age in 1910 numbered 268,268, and those not of bearing age, 172,186. The production in 1909 was 31,748 bushels, valued at \$36,872. Cherry trees of bearing age in 1910 numbered 51,613; those not of bearing age, 76,293. The production in 1909 was 5,924 bushels, valued at \$12,981. Other orchard-fruits produced in 1909 were 162 bushels of pears, valued at \$447; 148 bushels of peaches and nectarines, valued at \$167; and 120 bushels of mulberries, valued at \$123. The value of the apricots and quinces was of little or no importance.

The production of grapes in 1909 was 144,634 pounds, valued at \$4,789. The grape-vines of bearing age in 1909 numbered 38,647; those not of bearing age, 46,891.

The production of nuts in 1909 was 73,715 pounds, valued at \$1,511. The only important nut in South Dakota in 1909 was the black walnut, the production of this alone being 72,659 pounds, valued at \$1,490.

Of the small-fruits grown in South Dakota, strawberries are the most important, with raspberries and loganberries ranking next. The acreage of strawberries increased from 62 in 1899 to 226 in 1909, when the production was 238,164 quarts, valued at \$26,764. Raspberries increased in acreage from 21 in 1899 to 66 in 1909, when the production was 60,285 quarts, valued at \$8,703. Currants increased in acreage from 38 in 1899 to 67 in 1909, when the production was 52,951 quarts, valued at \$6,021. Gooseberries increased in production from 25 in 1899 to 55 in 1909, when the production was 43,408 quarts, valued at \$4,926. Other small-fruits produced in 1909 were 6,055 quarts of blackberries and dewberries, valued at \$809; and 288 quarts of cranberries, valued at \$25.

The acreage of potatoes increased from 33,567 in 1899 to 50,052 in 1909, when the production was 3,441,692 bushels, valued at \$1,967,550. The more important of the other vegetables produced were: 175 acres of cabbage, valued at \$13,759; 104 acres of onions, valued at \$13,133; 579 acres of sweet corn, valued at

\$12,018; 212 acres of watermelons, valued at \$10,625; and 62 acres of tomatoes, valued at \$4,335. Vegetables of lesser importance produced in 1909 were: asparagus, green beans, cantaloupes and muskmelons, pop-corn, green peas, and turnips.

The acreage devoted to the growing of flowers and plants increased from 14 in 1899 to 19 in 1909. The total area under glass in 1909 was 101,460 square feet, of which 92,240 were covered by greenhouses, and 9,220 by sashes and frames. The value of the flowers and plants produced in 1909 was \$50,008, as compared with \$3,260, in 1899.

The acreage devoted to nursery products increased from 200 in 1899 to 399 in 1909, when the production was valued at \$70,827, as compared with \$12,866, in 1899.

N. E. HANSEN.

Nebraska.

The state of Nebraska (Fig. 2506) presents a variety of horticultural conditions, owing to the varied topography, the diversity of soil, and the wide range of altitude and climate. The eastern part of the state is rolling prairie, the great loess plains, broken and almost rough, near the Missouri River. The soil is deep and fertile and the undulating surface amply provides both soil and atmospheric drainage. The central part of the state has a more uniform surface but is subject to a high rate of evaporation, owing to dry winds. In the west-central part of the state lie the sand hills where the soil is very light, though many fertile valleys lie between the hills, and the rate of evaporation is equally high. South of the sand hills are prairie lands or loess plains where irrigation is practised to some extent. South and west lie high prairies or the Cheyenne plains. Several extensive orchards are grown here under irrigation. To the north and west are the buttes and "bad lands." The elevation of the south-eastern part of the state is 850 feet at its lowest point in Richardson County and averages 1,200 feet along the entire eastern part of the state close to the Missouri River, while the extreme western part exceeds 5,000 feet. The rainfall gradually decreases from east to west, as the elevation increases. Nebraska is fortunate in that the rainfall is greatest when most needed for agriculture, namely, April, May, June and July. Because of the great diversity of conditions, the State Horticultural Society has divided the state into nineteen districts, as indicated on the accompanying map, which are generally considered in making recommendations for fruit-culture.

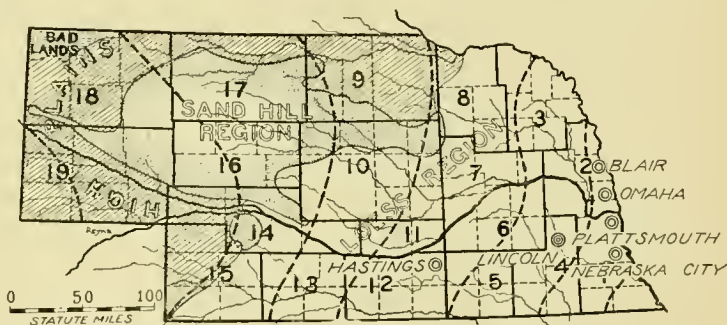
Apples form the most important horticultural crop, but, except under irrigation, are grown commercially principally in the southeastern half of the state, known as the Great Loess region. However, commercial orcharding is gradually extending westward. Commercial orcharding under irrigation is being carried on in the central, southern, and western parts of the state, principally in Lincoln, Scott's Bluff and Red Willow counties.

District No. 1 is perhaps the best apple-growing region of the state. Here is the natural home of the Jonathan apple, where it attains its highest degree of excellence. Other standard varieties thrive almost as well. Perhaps more Ben Davis apples are shipped from this section than from any other part of the state. The rainfall is ample and well distributed throughout the year. The large amount of bright sunlight during the time when most of the fruit is ripening perhaps accounts for the high color, good quality and excellent keeping properties of Nebraska fruit. District No. 2 follows No. 1 so closely in amount and quality of apples grown that the region might well be known as one district, the chief

difference being that the former has a rougher surface, higher altitude, and lies farther north, making injury from frost more liable. Districts Nos. 3, 4, 5, 6, 7, 8, 11 and 12, while not so favorably located, lie within the commercial apple district and produce immense quantities of excellent fruit. Districts Nos. 9, 10, 13 and 14 require careful cultural methods, but with proper care apples are grown successfully, though perhaps other farm crops, with live-stock, will give larger returns than commercial orcharding. However, the home orchard, well cared for, is one of the greatest assets of the farmstead.

Throughout the remainder of the state, much care must be exercised in the propagation of apples except under irrigation, although there are many thriving home-orchards. The dry seasons, prevailing light soil, and cold winters, especially in the northwestern part of the state, make winter-killing liable.

The Winesap is the favorite commercial variety the state over, with the Jonathan as a close second and Ben Davis third. The dry weather of the last three seasons, with the severe winter of 1911, and the severe attack of Illinois canker has proved fatal to many Ben Davis trees. The Jonathan apple is grown in the southern part of the state, where it has attained a world-wide



2506. Nebraska, showing the various areas or districts.

reputation. Other varieties which thrive in this state are: Summer—Duchess, Yellow Transparent, Cooper's Early White, Coles Quince, Early Harvest, Sweet June, Red Astrachan, Chenango Strawberry, and Red June; autumn—Wealthy, Utter's Red, Maiden's Blush, Fulton Strawberry, Flora Belle, Plum Cider, Fameuse, Porter and McMahon's White; winter—Gano, Windsor, Grimes' Golden, Janet, Northwestern Greening, Black Twig, Ingraham, Missouri Pippin and Iowa Blush.

Pears are successfully grown throughout the southeastern part of the state, though few large commercial orchards exist. The trees are liable to winter-kill if planted too far north and west, while susceptibility to fire blight is the controlling factor in the southeast. The principal varieties are Kieffer, Bartlett, Sheldon, Flemish Beauty and Seckel.

Native plums thrive over the entire state while European and Japanese varieties do well in the eastern and southern parts. American varieties are, Wyant, Wolf, Wild Goose, Forest Garden and DeSota; European—Lombarda, Shipper's Pride, Green Gage, Shropshire Damsion; Japanese—Burbank, Abundance and Wickson.

Peach-growing, commercially, is confined to the southeastern part of the state, where excellent crops are occasionally produced. The greatest difficulty lies in the late frosts which sometimes destroy the crops, and the liability to winter-killing of the fruit-buds, though some peaches are raised every year. Alexander, Early Rivers, Triumph, Russel, Champion, Bokara, Crosby, Hill's Chili, Heath Cling, Solway and Wright are the principal varieties.

Cherries thrive over the greater part of the state and

are remarkably free from insect and fungous injuries. Besides the native cherries, Early Richmond, Montmorency and English Morello are the leading varieties.

Grape- and small-fruit-growing is becoming one of the leading industries in the eastern part of the state, especially in Districts Nos. 1 and 2, where much wine is manufactured and immense quantities of fruit shipped out every year. The grape has been exceptionally free from insect and fungous enemies until very recently when black-rot and the grape root-worm have caused serious losses in some localities. The leading varieties are Concord, Worden, Moore Early, Niagara, Moore's Diamond, and Woodruff Red.

Raspberries and blackberries suffer from drought and winter-killing except in the region close to the Missouri River, and here they form an important crop. Red raspberries are very little grown, being subject to winter-killing except in the immediate vicinity of the rivers. Strawberries now form one of the most important small-fruit crops in the eastern part of the state, especially in Districts Nos. 1 and 2 where fruit of the highest quality is produced. Senator Dunlap, Splendid, Bederwood, Crescent, Gandy, August Luther, Klondike, July and Sample are the varieties principally grown.

The nursery interests of the state are very important. Seedlings of all the important fruit, forest and shade trees are grown in large quantities. Propagation of varieties is carried on by root-grafting, budding and hardwood cuttings. The nurseries of the state supply not only the home trade but have a large and well-established business in other states.

Vegetable-gardening has taken its rightful place with the other industries in Nebraska. Both vegetables grown in the field and under glass yield abundantly and are of excellent quality. More vegetable-gardening is done in District No. 2 than any other part of the state, although the irrigated lands in the Scottsbluff region are rapidly developing into a vegetable-producing section. Canneries are being established and the indications are that there will be a still more rapid increase in vegetable-growing in the near future. The beet-sugar factories afford a ready market for sugar-beets, the acreage of which is rapidly increasing. The acreage planted to potatoes each year is also rapidly increasing in spite of potato diseases and occasional droughts. Marketing associations are being formed at various points to facilitate the distribution. Early varieties are grown principally, the leading potato being the Early Ohio. Many acres of tomatoes are grown every year and sold to the canneries. All varieties of root crops do well throughout the state, but the cucurbits are grown with most satisfactory results only on sandy loam soil of the Platte River valley, and a few other particularly suitable locations. The growing of pure-bred garden seeds also receives a great deal of attention.

Ornamental gardening and floriculture are receiving their due share of attention throughout the state, especially about the cities. The excellent markets have made greenhouse work very popular and a large number of persons receive employment in this line.

Among the native wild fruits which are found abundantly along every stream, the following are the most common: Pawpaw (*Asimina triloba*), in the eastern part; late wild grape (*Vitis cordifolia*), over the entire state; early wild grape (*Vitis riparia*), over the entire state, the latter ripening much earlier than the former and being much more palatable; wild plums (*Prunus americana*), over the entire state; choke-cherry (*Prunus virginiana*), over the entire state; wild cherry (*Prunus serotina*), eastern part of state; sand cherry (*Prunus pumila*), very common in the central and western parts of the state on dry sandy lands; wild cherry (*Prunus demissa*), common throughout the region from "Long Pine" westward and is much more palatable than the choke-cherry; wild strawberry (*Pragaria virginiana* var.

illinoensis), very common wherever moisture is sufficient; wild red raspberry (*Rubus strigosus*), in the eastern part of the state; wild black raspberry (*Rubus occidentalis*), very common over eastern half of state; wild blackberry, very common over eastern half of state; wild crab-apple (*Pyrus coronaria*), eastern part of the state; juneberry (*Amelanchier canadensis*), in the eastern part of the state; wild gooseberry (*Ribes rotundifolium*), very common in the eastern part of the state; golden currant (*Ribes aureum*), very common; elder (*Sambucus racemosa*), very common; persimmon (*Diospyros virginiana*), southeastern part; buffalo berry (*Shepherdia argentea*), along Platte River; red mulberry (*Morus rubra*), in the eastern part.

Early horticulture in Nebraska was very discouraging. Persons coming to Nebraska and not acquainted with conditions insisted on planting varieties of trees unsuitable to this region, because of their excellence on the old "home place," or, being entirely unfamiliar with the varieties, allowed some eastern nurseryman to choose for them. The results were such that further planting was discouraged. The deep fertile soils of Nebraska produced such abundant crops of corn and small grain that orchard-planting was retarded. The trees were as a rule set too close together, and in the rush of general farming, neglected. Young trees were set in sod and if they reached the age of bearing soon bore themselves to death. Added to this came the invasions of insects and fungous diseases. But here, as in the face of other great dangers, leaders were developed, men with courage and determination who have succeeded in overcoming many of the difficulties. Systematic spraying was commenced. Scientific pruning and cultural methods were developed.

Nebraska has awakened from her lethargy and has become a state of pioneers in horticulture. Amateur horticulturists are numerous and horticultural specialties are rapidly developing. Better methods have developed special crops. Canning factories have been established and plants for the handling of by-products, such as cider-mills, vinegar-factories, wine-presses, and the like are numerous throughout the state.

The present high rank of horticulture in Nebraska is due largely to the untiring efforts of the early pioneers who not only planted large numbers of fruit trees themselves, but encouraged and assisted others to do the same. Among these may be mentioned: W. J. Armstrong, of Otoe County; J. Sterling Morton, who besides fruit-trees planted trees and shrubs of every species and variety which he thought would thrive in the vicinity of Nebraska City; he was the originator of Arbor Day, and to him is due in a large part many of the beautiful plantings and groves of trees found in the state today; Oliver Harmon, who planted not only fruit-trees and vines but forest trees as well; J. H. Masters, who besides extensive plantings of fruit and forest trees, engaged heartily in beekeeping; Wm. Fulton, who planted an orchard near Nebraska City; Benton Aldrich, who planted apple and peach orchards in Nemaha County, near Auburn; Joseph Bennett; Bird Vowell, who planted orchards near Auburn; S. Barnard, who established a nursery and planted an orchard at Table Rock; R. W. Furnas, ex-Governor of Nebraska, who planted a large orchard near Brownville, and carried on many experiments; J. M. Russell, who planted a peach orchard near Wymore, and who, besides demonstrating that peaches could be grown in Nebraska, originated many excellent varieties.

Public-service agencies for horticulture.

The Land-Grant college of Nebraska was established at Lincoln in 1871. There are three teaching members of the horticultural staff.

The Experiment Station is also located at Lincoln. There are also two experimental substations, the North Platte Experimental Substation, 4 miles south of the

city of North Platte, and the Valentine Experimental Sub-station, near the town of Valentine.

In addition to the work done at the College of Agriculture, horticulture is now being taught at the State Normal schools of Peru and Kearney, the School of Agriculture at Curtis, and in connection with agriculture in almost every high-school in the state.

Extension work is conducted in connection with the College, one man devoting his entire time to this work.

The Nebraska State Horticultural Society was organized in 1869, with J. H. Masters as first president. Local fruit-growers' associations have been formed in all the leading districts, and in 1912 the Eastern Nebraska Fruit-Growers' Association was formed. A uniform system of packing and grading has been adopted which, with the present shipping facilities, insures proper distribution and good prices for horticultural products.

Statistics (Thirteenth Census).

The approximate land area of Nebraska in 1910 was 49,157,120 acres. The land in farms was 78.6 per cent of the land area, or 38,622,021 acres. Of this land in farms 21,382,557 acres were improved; 803,206 were woodland; and other unimproved land in farms numbered 13,436,238 acres. The number of all the farms in 1910 was 129,678. The average acreage to a farm was 297.8. [The total area of the state is 77,520 square miles.]

The leading agricultural crops of Nebraska are cereals and hay and forage. The acreage of cereals increased from 12,071,703 in 1899 to 12,540,049 in 1909, when the value of the cereals produced was \$153,666,652, or 78.3 per cent of the total value of all crops. The acreage occupied by hay and forage increased from 2,823,652 in 1899 to 4,520,034 in 1909, when the value of the hay and forage produced was \$31,729,691, or 16.2 per cent of the total value of all crops. In 1909 sugar crops were produced, from 8,225 acres, to the value of \$241,272, the acreage being a decrease, however, of 38.8 per cent from that of 1899. The forest products of farms in 1909 was valued at \$795,053, as compared with \$412,746 in 1899.

Horticultural crops produced in Nebraska are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$2,078,340, as compared with \$761,053 in 1899. Small-fruits increased in acreage from 1,171 in 1899 to 1,411 in 1909, an increase of 20.5 per cent, when 1,594,421 quarts were produced, valued at \$159,169. In 1909 the total acreage of potatoes and other vegetables was 147,594 and their value \$5,931,738. Excluding potatoes and sweet potatoes and yams, the acreage of other vegetables increased from 34,532 in 1899 to 36,164 in 1909, when the value of the vegetable products was \$2,118,393. Flowers and plants and nursery products increased in acreage from 1,680 in 1899 to 2,091 in 1909, when the value of the products was \$909,221.

The total production of orchard fruits in 1909 was 3,572,253 bushels, valued at \$1,932,124. More than nine-tenths of this quantity was produced by apples, and most of the remainder by peaches and nectarines and cherries. The apple trees of bearing age in 1910 were 2,937,178; those not of bearing age 967,133; and the production in 1909 was 3,321,073 bushels, valued at \$1,612,765. Peach and nectarine trees of bearing age in 1910 numbered 1,188,373; those not of bearing age 263,882; and the production in 1909 was 110,180 bushels, valued at \$91,129. Cherry trees of bearing age in 1910 numbered 494,468; those not of bearing age 267,529; and the production of cherries in 1909 was 89,876 bushels, valued at \$164,872. Other orchard-fruits produced in 1909 were: 6,700 bushels of pears, valued at \$9,802; 41,910 bushels of plums and prunes, valued at \$50,934; 864 bushels of apricots, valued at \$1,229; 995 bushels of quinces, valued at \$993; and 665 bushels of mulberries, valued at \$400.

The production of grapes in 1909 amounted to 4,752,217 pounds, valued at \$137,295. The grape-vines of bearing age in 1910 numbered 1,221,736; those not of bearing age, 380,788.

Nuts were produced in Nebraska in 1909 to the amount of 384,325 pounds, valued at \$8,906. The black walnut is the only nut of importance, the production in 1909 being 381,968 pounds, valued at \$8,740.

Of the small-fruits grown in Nebraska, strawberries are the most important, with blackberries and dewberries second. The acreage of strawberries increased from 369 in 1899 to 562 in 1909, when the production was 654,061 quarts, valued at \$65,772. Blackberries and dewberries increased in acreage from 152 in 1899 to 428 in 1909, when the production was 501,872 quarts, valued at \$46,648. The production of raspberries and loganberries was 265,183 quarts, valued at \$29,841; that of currants 90,779 quarts, valued at \$8,592; and that of gooseberries 82,086 quarts, valued at \$8,259.

The acreage devoted to potatoes increased from 79,901 in 1899 to 111,151 in 1909, when the production was 8,117,775 bushels, valued at \$3,785,224. The acreage of sweet potatoes and yams decreased from 551 in 1899 to 279 in 1909, when the production was 28,500 bushels, valued at \$28,121. The more important of the other vegetables produced were 3,167 acres of sweet corn, valued at \$46,208; 725 acres of watermelons, valued at \$36,223; 2,167 acres of pop-corn, valued at \$33,854; 348 acres of cabbage, valued at \$27,144; 282 acres of tomatoes, valued at \$21,012; and 163 acres of onions, valued at \$18,659. Vegetable of lesser importance were asparagus, cantaloupes and muskmelons, celery, cucumbers, squash, and turnips.

The acreage devoted to flowers and plants increased from 86 in 1899 to 94 in 1909. The total area under glass in 1909 was 844,010 square feet, of which 790,305 were covered by greenhouses, and 53,705 by sashes and frames. The value of the flowers and plants in 1909 was \$356,168, as compared with \$142,636 in 1899.

The acreage devoted to nursery products increased from 1,594 in 1899 to 1,997 in 1909, an increase of 25.3 per cent. The value of the nursery products in 1909 was \$553,053, as compared with \$234,033, in 1899.

J. R. COOPER.

Kansas.

The commercial horticulture of Kansas (Fig. 2507) is in large part centralized in a few localities. Twenty-five counties produced about nine-tenths of the 10,000 carloads of apples sold in 1912. The last tenth is grown in many scattered localities that are especially suited for horticultural work, sheltered valleys where the soil is deep, rich and always moist. In nearly every one of the remaining eighty counties successful fruit and vegetable plantations may be found. Sixty counties contributed more than two carloads of peaches to the total of 1,300 carloads sold in 1912. Thirty counties contributed one or more carloads of strawberries to the total of 300 cars sold in 1913.

Two sections of the state have large areas of land particularly suitable for horticultural products. The northeastern counties have a considerable area of glacial soils that is well suited to fruit-growing and in which the area devoted to fruit may be expected to increase constantly. The Arkansas Valley has a large acreage of sandy loam underlaid with a porous clay subsoil which has proved to be well suited to fruit-growing. The inexhaustible supply of water which may be cheaply secured for irrigation by pumping has recently been utilized in commercial orchards and gardens and the possibilities of this region are not easily estimated.

A large proportion of Kansas will for long years to come be devoted to grain- and stock-farming. Thousands of acres well suited to fruit and truck crops are devoted to corn, wheat, alfalfa, and grass. Fruit- and

truck-farmers may be found prospering near every city and large quantities of their products are shipped from many points in the northeast counties and the Arkansas Valley towns.

The early fruit-growers planted large numbers of varieties that proved to be poorly suited to Kansas climate. Such standard eastern varieties as Hubbards-ton, Northern Spy, Baldwin and Rhode Island Greening ripened prematurely and had to compete with the fall varieties. These have been dropped from the list of recommended varieties. In this era of elimination the varieties which have been retained are those that have generally proved productive and profitable. Grimes', Jonathan, Winesap, York Imperial, Stayman, Arkansas or Black Twig, can compete in any market for the highest prices.

In the northeastern counties, most of the orchards are kept in clover or orchard-grass much of the time, to prevent erosion. That these deep moist soils are well adapted to this system of management is indicated by the successful crops borne in seasons when the rainfall is much below the normal. In the Arkansas Valley clean cultivation and cover-crops are the rule.

The barrel is the favorite package and a large part of the crop finds a market in the cities and towns of the states north and east. Barreling in the orchard is a common method, and the fine autumn weather usually occurring in this section makes this an economical practice. The fruit from the Arkansas Valley orchards is graded more closely as a rule, and the grades, fancy and extra fancy, packed in bushel boxes for the southern and southeastern markets. The fruit below fancy grades usually has found a ready market in the "wheat country" of the central and western part of this state and the "cotton belt" of Oklahoma and northern Texas. Some of the more isolated orchards have sold their entire crop to the "wagon trade" from surrounding farm country. The fancy grades compete in any market with the best grown anywhere. Grimes, Jonathan, Rome Beauty, and Winesap are the quality apples of Kansas and nowhere do they reach a higher degree of perfection.

Early apples are increasing in favor with the Arkansas Valley growers. Good markets have been the rule, and this section can send good pie stock to market by July 1 and good dessert apples by July 15. Early Harvest and Red June have been largely replaced by Yellow Transparent, Cooper, and Wealthy. Maiden Blush is still in favor and Liveland Raspberry is being set in considerable numbers.

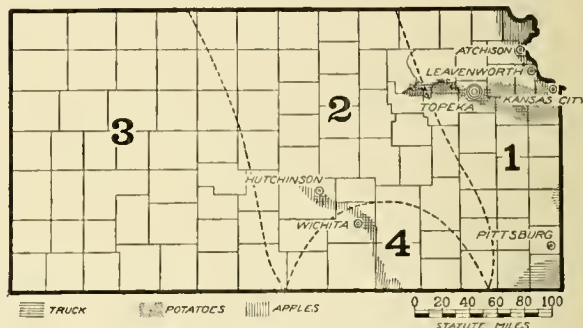
In spite of the erratic climatic conditions, peaches are grown in many counties. The Kansas grower sets peaches with the expectation that late frosts will injure at least half the crop in the northern half of the state and one-third in the southern half, but even with such losses occurring, when well cared for, peaches give good returns. Elberta has been more generally planted than any other variety, owing to its desirability as a shipper and canner, but many growers who supply local markets plant a number of varieties. Amsden, Champion, Greensboro, Triumph, Carmen, Mountain Rose, Crawford, Bonanza, Solway, Family Favorite, and Crosby have been generally successful. Many farmers still plant seedlings in a small way.

Sour cherries and the cultivated native plums are successfully grown in a variety of soils, but large plantings are seldom set. The *Labrusca* varieties of grape are particularly successful in the northeastern counties, and the vineyard acreage is increasing. In the southern counties the *Labrusca* varieties are to some extent being succeeded by some of Munsen's hybrids of *Vitis Lincecumii*.

The acreage of small-fruits has fluctuated in some sections, but the total acreage has steadily increased. Wathena and Troy in Doniphan County have made larger shipments than any other points, but large

quantities are marketed locally by growers near the larger cities and towns.

Potatoes and sweet potatoes are shipped from the state in considerable quantities. The sandy soils of the Kansas and the Arkansas valleys produce most of the earlot shipments. Both Irish and sweet potatoes are grown for local market in most of the counties and a large part of the Irish potato crop is dug early and sold as new potatoes. The acreage devoted to sweet potatoes increases steadily. The northern and western markets seem to prefer the dry-fleshed potato from Kansas to the moister varieties of the South. The Yellow Jersey is the most widely grown, the short, well-shaped roots developing early giving the growers a chance at the early markets North and West, and a considerable



2507. Kansas, with the four main regions.

part of the crop is dug and shipped for this early trade. This practice of selling early accounts, in a large measure, for the low-acre yields often reported by growers of Irish and of sweet potatoes, while the profit an acre compares well with other localities.

Several localities in southern Kansas have developed an extensive trade in vegetables with Oklahoma and Texas towns, shipping corn, tomatoes and melons south after their early truck crops have been marketed.

Watermelons are grown on a large scale in many localities. In earlier years the watermelon crop was uncertain owing to the injury from the melon house, which infested fields where the crops were grown continuously for a number of years. With the general adoption of a reasonable rotation, Kansas is a regular factor in the late melon market. The difficulty of having the soil sufficiently rich for melons and not over strong for sweet potatoes is met by using corn or Irish potatoes or tomatoes between melons and sweet potatoes. Alfalfa is now being grown on soils that a few years ago were considered hopeless for that crop. Manure is an essential in getting alfalfa started in these sandy soils, but, once started, it yields well and the soil can be made ready for melons. One great value of alfalfa as a crop to precede melons is the comparative freedom from weeds.

Near Kansas City, Leavenworth, Atchison, Topeka, and Wichita, a considerable interest in cut-flower crops is being developed, and many of the smaller cities afford good support to local florists. Near the larger cities an increasing industry is the summer crop of cut-flowers. Peonies for the Memorial Day trade are gaining in favor and thousands of buds are held in cold storage for this demand. Gladioli and summer crops of roses usually prove fairly profitable.

The nursery business has long been important in this state. For years large areas of apple seedlings have been grown in the Kansas River Valley. The deep, strong soil produces a very high-grade stock and growers are improving their methods, generally using alfalfa in rotation chosen to secure the best possible condition of soil. The state ships many earloads of nursery stock other than apple stock and the trade increases steadily.

The forest tree nursery business has changed considerably in recent years. In the early days of the "Timber Culture Act," when a settler might secure a quarter-section of land for planting 10 acres of the tract to trees, any sort of tree seedling could be profitably grown. Those were the days of the enthusiasm for the "hedge fence," and millions of osage orange seedlings were grown. Today the hedge is in disrepute. The cost of careful maintenance is high in labor, and the cost of neglect is high in injury to the fields, and Kansas hedges are the victim of the stump-puller. The catalpa is still set for posts and poles, and is on a safer basis than in former years. The lesson of the worthlessness of all species except *Catalpa speciosa* was an expensive one. The fact that it is not well adapted to high dry soil has been demonstrated, as has its value for rich moist soil, and lands subject to overflow are being planted to catalpa and walnut. Many settlers who planted cottonwood as roadside trees thirty or more years ago are sawing lumber and finding that the cottonwoods pay rent for the land. The Kansas farmers are planting better trees than they did a generation ago. The box elder, soft maple, and poplars have given way to elms, hackberry, sycamore, oaks, walnut, and pecan in the eastern section, and the honey locust, elms, hackberry, osage orange, and Russian olive have proved valuable in even the drier soils. The red cedar is the only native evergreen, and since it has been shown that a two-year stratification or mechanical removal of the gummy coat makes its propagation fairly certain, it has been grown more largely than ever before. It is one of the most adaptable trees in the list, growing in every county in Kansas. The bull pine or western yellow pine, *Pinus ponderosa*, is well suited, and the Austrian and the Scotch pines are good trees for Kansas.

In the boom days of Kansas every citizen felt in duty bound to believe that every crop of the temperate regions could be grown here with less effort than elsewhere and that all the varieties of soil were equally fertile. The modern Kansan is learning that the great variety of soils and conditions gives opportunity for many lines of agricultural industry and that the welfare of the state is best secured by using crops best suited to soil and conditions. The men who have succeeded in the various lines of horticulture have done so by using the natural resources in a rational way. Some of the big orchards set in the early days on suitable soils have proved to be valuable properties, but careful work has been given them. Others set in a spirit of speculation with no investigation of soil suitability or with little idea of the value of varieties have not been particularly profitable.

Public-service agencies for horticulture.

The State Agricultural College is at Manhattan, and has from its earliest years maintained a Department of Horticulture. For some years the work in entomology was combined with that of horticulture and the two lines of work have always been closely associated. Experiments in the control of fruit insects were one of the first lines of activity undertaken when the Experiment Station was founded in 1887.

The Extension Division of the College has maintained a publicity bureau that has done much in getting buyers and producers of fruit into communication. The College renders considerable service in the matter of civic improvement, members of the staff visiting many localities delivering lectures, making suggestions and preparing plans for parks, cemeteries and the grounds for public buildings.

In several localities coöperative associations have been formed for the promotion of horticultural interests. The Wathena Fruit Growers' Association is the largest, shipping each season hundreds of carloads of fruit grown by its members.

The State Horticultural Society in its fifty years of service has accumulated a wealth of information that is proving to be a safe foundation for horticultural enterprises. There are a number of county and local horticultural societies which have served their communities faithfully and well.

Statistics (Thirteenth Census).

The approximate land area in 1910 was 52,335,360 acres; the land in farms 43,384,799 acres, or 82.9 per cent of the land area. The improved land in farms was 29,904,067 acres, or 68.9 per cent of the land area in farms. There were 1,205,910 acres of woodland in the farms and 12,274,822 acres of other unimproved land in farms. The total number of farms in Kansas in 1910 was 177,841. The average number of acres to a farm was 244. [The total area of Kansas is 82,158 square miles.]

The leading agricultural crops of Kansas are cereals and hay and forage. Of the total value of all crops in 1909, 78.7 per cent was contributed by cereals and 14.9 per cent by hay and forage. The acreage of cereals increased from 13,326,940 in 1899 to 15,638,669 in 1909, when the value of the production was \$169,109,449. Hay and forage decreased in acreage from 4,337,342 in 1899 to 3,957,745 in 1909 when the production was valued at \$32,033,954. Broom-corn was produced to the value of \$593,947 in 1909, and sugar crops to the value of \$508,024. The value of the forest products of the farms in 1909 was \$1,336,950, as compared with \$837,997, their value in 1899.

Horticultural crops grown in Kansas are fruits and nuts, small-fruits in a limited amount, vegetables to quite a large extent and flowers and plants and nursery products. The value of all fruits and nuts produced in Kansas in 1909 was \$1,136,977, as compared with \$2,031,406 in 1899. The acreage occupied by the small-fruits decreased 7.3 per cent, from 5,824 acres in 1899 to 5,400 acres in 1909, when the production was 5,477,274 quarts, valued at \$454,200. Vegetables, including potatoes, occupied, in 1909, an acreage of 132,665 and the value of their products was \$6,808,653. The raising of flowers and plants and nursery products is of some importance in Kansas, 4,164 acres being devoted to them in 1909, with an output valued at \$1,222,208.

The production of all orchard fruits was 58.8 per cent less in 1909 than in 1899. The total production of orchard fruits in 1909 was 1,447,849 bushels, valued at \$944,631. Apples produced more than nine-tenths of this quantity, with cherries ranking next in importance. The apple trees of bearing age in 1910 numbered 6,929,673; those not of bearing age 1,116,316. The production in 1909 was 1,356,438 bushels, valued at \$807,865. Cherry trees of bearing age in 1910 numbered 661,267; those not of bearing age, 237,051. The production in 1909 was 34,409 bushels, valued at \$76,734. Quantities of other fruits grown in 1909 were: 24,567 bushels of peaches and nectarines, valued at \$23,418; 19,412 bushels of pears, valued at \$21,543; and 12,250 bushels of plums and prunes, valued at \$14,001. In addition, small quantities of quinces, apricots and mulberries were produced.

The production of grapes declined from 15,786,019 pounds with a value of \$297,000 in 1899 to a production of 6,317,684 pounds with a value of \$184,673 in 1909. The number of grape-vines of bearing age in 1910 was 2,889,845; those not of bearing age numbered 343,002.

The production of nuts in Kansas is of minor importance. In 1909 the most important nut was the black walnut, of which 377,649 pounds were produced, valued at \$6,033. The other nut of importance is the pecan, of which 20,583 pounds were produced in 1909, valued at \$1,462. In addition, 3,950 pounds of hickory-nuts, valued at \$107, and 275 pounds of chestnuts, valued at \$19, were produced in 1909.

Blackberries and dewberries are the most important

of the small-fruits raised in Kansas, with strawberries second in importance. The acreage of blackberries and dewberries increased from 2,044 in 1899 to 2,682 in 1909, when the production was 2,535,918 quarts, valued at \$201,134. The acreage of strawberries decreased in the same period from 2,304 in 1899, to 1,719 in 1909, when the production was 2,119,048 quarts, valued at \$178,094. The productions of other berries of importance in 1909 were: 616,035 quarts of raspberries and loganberries, valued at \$56,446; 138,772 quarts of gooseberries, valued at \$12,460; and 67,005 quarts of currants, valued at \$6,023.

Among the vegetables, the potato is by far the most important. In 1909 the acreage devoted to potatoes was 79,025 from which were produced 5,647,049 bushels, valued at \$3,471,488, more than the value of all the other vegetables. The more important of the other vegetables, their acreage, and value of their products in 1909 follow: sweet potatoes and yams, 4,883 acres, valued at \$373,432; watermelons, 3,317 acres, valued at \$131,527; tomatoes, 1,237 acres, valued at \$84,937; sweet corn, 3,653 acres, valued at \$75,499; cabbage, 1,007 acres, valued at \$55,812; and onions, 243 acres, valued at \$29,753. Other vegetables grown were asparagus, green beans, cantaloupes and muskmelons, pop-corn, cucumbers, lettuce, green peas, rhubarb, and turnips.

The acreage devoted to the growth of flowers and plants increased from 75 in 1899 to 161 in 1909. The total area under glass in 1909 was 781,498 square feet, of which 728,421 were covered by greenhouses and 53,077 by sashes and frames. The value of the plants and flowers produced in 1909 was \$273,715, as compared with \$79,765, their value in 1899.

The acreage devoted to the growth of nursery products increased from 3,449 acres in 1899 to 4,003 acres in 1909, an increase of 16.1 per cent. The value of the nursery products in 1909 was \$948,493, as compared with \$447,053 in 1899.

ALBERT DICKENS.

SOUTH ATLANTIC STATES.

Delaware.

Geographically, Delaware (Fig. 2508) is divided into three counties, New Castle in the north, Kent in the center and Sussex in the south. Geologically, there are but two distinct regions, Piedmont, and Atlantic coastal plain. New Castle, the northern county, lies partially in the Piedmont region and partially in the coastal plain region, the northern portion being hilly and of a rolling topography and the remainder gently rolling with a gentle slope to south and east. The remainder of the state has no elevations of any consequence, the surface varying from slightly rolling in the north to flat, nearly level lands in the south. All along the eastern side of the state, many inlets and short navigable streams indent the coast. A narrow stretch of marshlands borders the coast from north to south. The greater part of the state lies below 100 feet above sea-level and the southern half lies below the 50 feet contour.

The soils of the state are well diversified; yet for the most part they are fertile and especially adapted to fruit- and vegetable-culture. The soil types of New Castle County vary greatly, while those of the other two counties are rather uniform. The principal soil types of Kent and Sussex counties are those of the Norfolk and Portsmouth series, viz., Norfolk loams and sands, and Portsmouth loams and sands.

The climate of the state is mild, the temperature, except in the extreme northern part, seldom falling below zero in winter. The close proximity of Delaware Bay on the east and Chesapeake Bay on the west has a decided modifying effect upon the climate. Injurious early fall frosts are practically unknown, while it is seldom that late spring frosts are limiting factors in

crop-production. The rainfall is approximately 40 inches a year. The distribution of this rainfall varies from year to year, but it is not often that the state suffers from excessive droughts.

The leading horticultural crops are tomatoes, asparagus, apples, peaches, grapes, pears, strawberries, cantaloupes, watermelons, peas, sweet potatoes and white potatoes. There are many kinds of vegetables grown for the city markets, but the above-mentioned are the principal ones grown on a trucking scale.

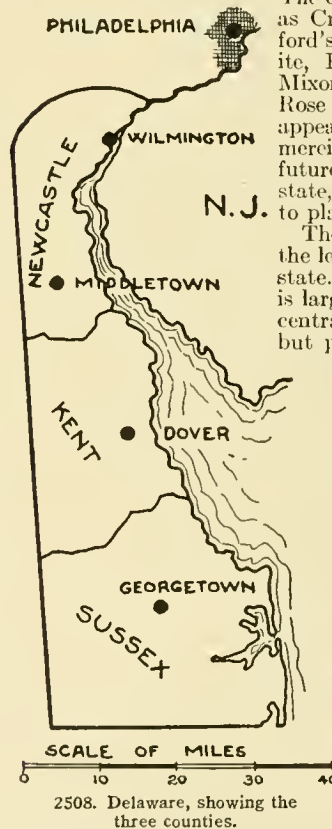
Delaware was formerly noted for its peach-production, which industry began in 1832. The high-water mark in peach-production was probably reached in the late sixties and early seventies. With the advent of the yellows and other peach diseases, the industry began to decline and reached its lowest ebb about 1910. Since that time a new interest has been aroused, better methods of culture are being practised and the business is rapidly centering into the hands of specialists. During 1914 and 1915, thousands of young peach orchards have been planted. Varieties have been standardized and most of the old-time favorites have disappeared. The principal varieties grown are Elberta, Belle of Georgia, Champion, Carman and Frances.

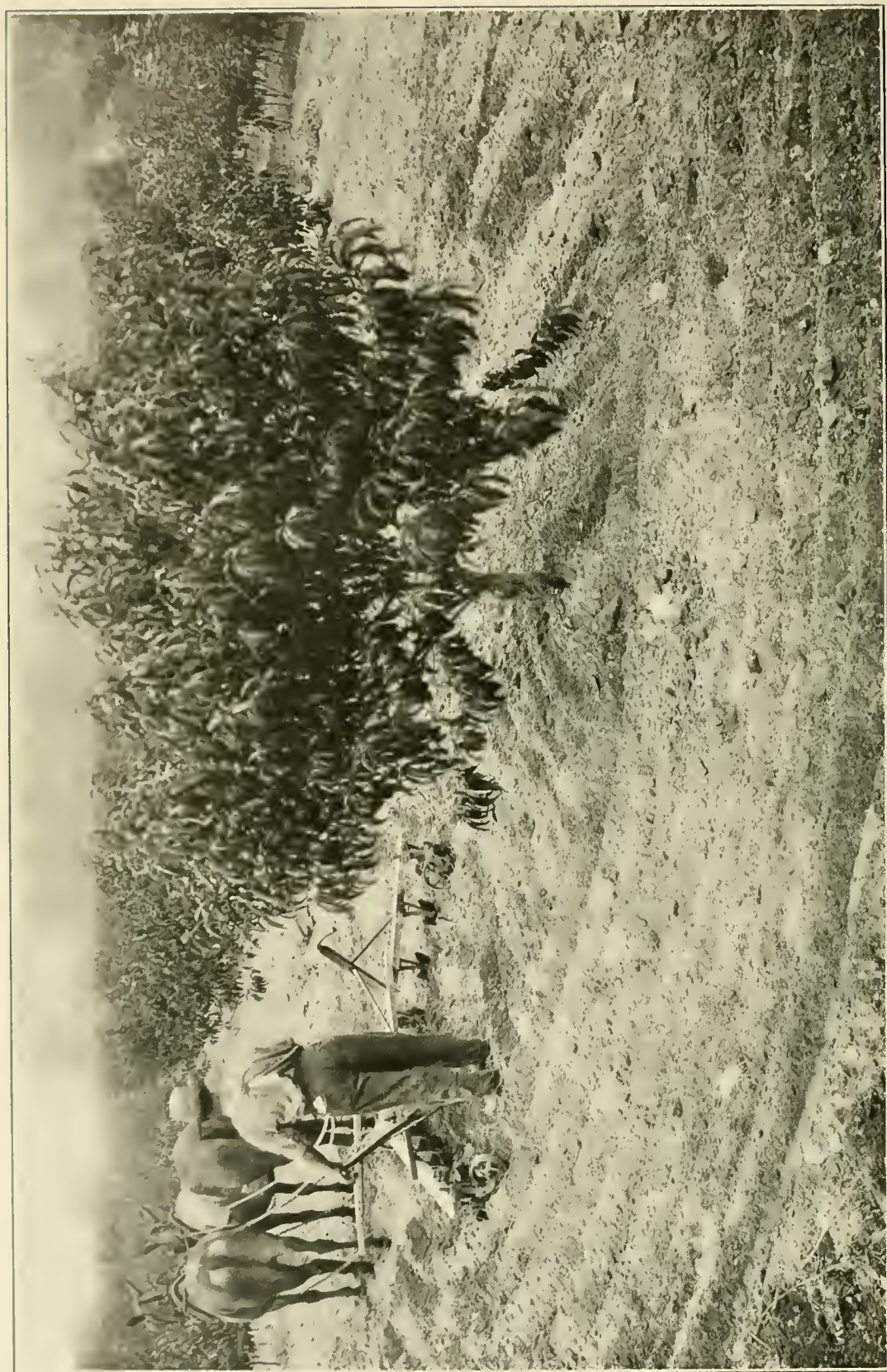
The old-time varieties, such as Crawford's Late, Crawford's Early, Moore's Favorite, Reeves Favorite, Old Mixon, Stump, Mountain Rose and Smock have disappeared from the commercial orchards. In the future horticulture of the state, the peach is destined to play an important part.

The apple is probably the leading tree-fruit of the state. The apple industry is largely centralized in the central part of the state; but practically one-half of

the farming area of Delaware is suitable for apple-culture. The industry began in central Kent County only a comparatively few years ago and it was not until about 1900 that the apple crop of the state began to attract attention. Delaware is especially suited to the production of certain varieties of winter apples of high quality and the growers are specializing in those varieties. Early apples do well and a large and profitable business is carried on in growing

Yellow Transparent, Early Ripe and Williams. The apple is destined to be a close rival of the peach and probably in a few years will surpass the latter in production and value. Unlike the peach industry, the apple industry has been in the hands of specialists from the very beginning and to this fact can be accounted its steady growth. The farmyard apple orchard plays but little part in the economics of Delaware apple-production. The principal varieties of late apples are Jonathan, Stayman, Paragon (Arkansas), Winesap, York Imperial, Nero, Rome and Grimes. Of these varieties, the Stayman is especially adapted to Delaware conditions.





LXXII. North American horticulture.—Peach orchard in eastern Maryland.

The grape industry as a commercial proposition is comparatively new. Although grapes have been grown in the northern part of Kent County since 1855, it is only within the last decade that grape-culture has come to occupy an important place in Delaware horticulture. The industry is centralized in two rather distinct regions, the older one near Clayton and Smyrna and a newer and what will probably prove to be a more extensive one, near Dover. The grape industry only awaits the advent of the grape-juice factory to bring it to its proper place among the horticultural products of the state.

Pear-production is on the wane. There are large plantings of Kieffer in Kent and southern New Castle counties; but of late years the pear crop has not proved very profitable. The old orchards have suffered from the pear-blight, leaf-spot and psylla. There are but few new plantings of pears being made and present indications (1915) are that the next decade will witness the passing of the pear industry. The northern part of New Castle County is especially adapted to the growing of varieties like Lawrence, Seckel, Duchess and Anjou.

As the next decade will probably witness the passing of the Kieffer pear, the past decade (1905-1915) has witnessed the passing of the plum. From 1895 to 1900, there were large plantings of Japanese plums made in the state. In 1899 there were 32,000 trees, while at the present time the plum crop is comparatively unimportant and the farmyard tree controls the output.

The strawberry is the most important horticultural crop grown in the state. Its cultivation is largely localized in Sussex County. There are two great strawberry districts in this county, one at Bridgeville in the western part and the other at Selbyville in the southeastern part. In the Selbyville district especially, strawberry-growing is the principal farm industry. The acreage in this district is constantly increasing. The agriculture of the Bridgeville district is more diversified and the strawberry-production, while great, is not so large as it was about 1912. This district has recently become a large producer of cantaloupes. The principal varieties of strawberries grown in the state are Gandy, Chesapeake, Superior, Klondyke and Parsons.

The tomato is king among vegetables in Delaware. With the exception of a small area in the northern part of New Castle County, tomatoes are grown for canning purposes over the entire state. In 1914 there were 150 canneries in operation in the state, all but two of them specializing in canning tomatoes. The principal varieties grown for canning purposes are Greater Baltimore, Success, Stone, Red Rock and Paragon.

Since 1911, the growth of the sweet potato industry in the state has been phenomenal. At the present time (1915), the principal sweet potato region is in the western part of Sussex County from Seaford southward through Laurel to Delmar. Seaford, Laurel and Delmar are the great sweet potato shipping centers.

The leading horticultural regions of the state are Kent County for apples and grapes; Kent and Sussex counties for peaches; Sussex County for strawberries, cantaloupes, sweet potatoes and watermelons.

While the climate and soil of the state are well suited to the production of the English walnut and chestnuts, the industry has not been developed. The ravages of the chestnut blight have practically destroyed the chestnut orchards and it is doubtful whether any new plantings will be made. Black walnuts grow naturally over a large part of the state. There are no cultivated orchards of this nut. A few pecans are grown, but the success of growing this nut in Delaware as a commercial venture has not as yet been demonstrated.

The census figures of 1909 regarding the greenhouse interests are misleading, as they show the industry of growing plants and flowers to be of more importance

than it really is. There are but few florists' establishments within the state.

The appreciation of fine landscape effects is steadily growing in the state. There are several large estates near Wilmington that have been well developed, such as the numerous Du Pont estates lying between Wilmington and the Pennsylvania line. The smaller towns and villages have been awakened to the need of parks and playgrounds and the next decade ought to witness a better appreciation of the beautiful in nature.

Practically few of the many varieties of fruit grown in Delaware have originated within her borders. Possibly the only variety of national fame that Delaware can lay claim to is the Reeves Favorite peach.

Among those men who have helped to form the horticulture of Delaware, may be mentioned Joseph Carter, of Smyrna, who may be called the father of the grape industry in Delaware, and J. G. Brown, of Wyoming, who had great influence in establishing apple-growing in the state.

Public-service agencies for horticulture.

The land-grant college of Delaware is Delaware College located at Newark. This college was established in 1833, but it was not until the passage of the Morrill Act in 1862 that any provision was made for teaching agriculture. The horticultural staff consists of two men who also devote their time to the work of the Experiment Station.

The Experiment Station is closely connected with the College. Aside from the land devoted to experimental growing of crops, the Station has forty concrete tree pits that are used for investigational work in the plant-food requirements of peaches.

There are no special horticultural schools in the state, but horticulture is taught as a part of the agricultural work in all the graded schools.

Extension work is carried on through the state by the College and also to some extent by the State Board of Agriculture.

The State Board of Agriculture controls the nursery inspection and all public matters concerned with the enforcement of horticultural laws.

Historically, geographically and horticulturally, Delaware is closely linked with the "Eastern Shore," of Maryland. This close community of interest of the two states has been recognized in the Peninsular Horticultural Society, whose membership is drawn not only from Delaware and Maryland but also from the "Eastern Shore" counties of Virginia. The Society has ever played a most important part in horticultural development of the two states, Delaware and Maryland.

Statistics (Thirteenth Census).

The approximate land area, according to the Census report of 1910, is 1,257,600 acres, of which 1,038,666 were in farms, or 82.6 per cent of the land area. The acreage of improved land is 713,538; that of woodland, 252,032, and other unimproved land in farms, 73,296 acres. The total number of farms in Delaware in 1910 was 10,836, the average acreage of which was 95.9 acres. [The total area of Delaware is 2,370 square miles.]

The leading agricultural crops are cereals and hay and forage. The land occupied by cereals in 1909 was 43.3 per cent of improved land, or 309,288 acres, as compared with the acreage in 1899, when it was 318,772. The value of the products in 1909 was \$4,692,329. The acreage of hay and forage in 1909 was 80,669, as compared with 74,800 in 1899, showing an increase of 7.8 per cent. The value of hay and forage in 1909 was \$1,174,473. The forest products sold from the farms in 1909 amounted to \$346,062 in value.

The horticultural crops grown are vegetables, small-fruits, fruits and nuts, and flowers and plants, and nursery products. In 1909, the total acreage of vegetables, including potatoes, was 37,871 and their value

\$1,832,699, as compared with an acreage of 32,007 in 1899, valued at \$1,144,221. The value of the fruits and nuts grown in 1909 was \$240,704 as compared with \$295,518 in 1899. The acreage of small-fruits in 1909 was 8,687, a decrease of 18 per cent from 1899, when the acreage was 10,599. The value of the small-fruits in 1909 was \$619,732. Flowers and plants and nursery products in Delaware increased in acreage from 201 in 1899 to 226 in 1909, when the value of their products was \$110,486.

Of the orchard-fruits in 1909, the apples produced more than one-half of the total production, and pears most of the remainder. The number of bearing apple trees in 1900 was 429,753; those not of bearing age, 263,813. The production in 1909 was 183,094 bushels, valued at \$115,371. The pear trees of bearing age in 1910 were 449,692; those not of bearing age, 90,917. The production in 1909 was 105,357 bushels, valued at \$52,022. The peach and nectarine trees of bearing age in 1910 were 1,177,402; those not of bearing age, 212,117. The production in 1909 was 16,722 bushels, valued at \$21,402. Other of the orchard fruits, their production and value in 1909 were: cherries, 2,634 bushels, valued at \$4,850; quinces, 806 bushels, valued at \$1,572; plums and prunes, 657 acres, valued at \$540.

The production of grapes was 1,938,267 pounds, valued at \$43,967. The grape-vines of bearing age from 1,309 farms reporting, in 1910 numbered 260,963; those not of bearing age from 265 farms reporting numbered 98,950.

The production of nuts is an unimportant industry. The production of all nuts in 1909 was 39,142 pounds, valued at \$964, of which 35,200 pounds were black walnuts, valued at \$581.

Strawberries are by far the most important of the small-fruits raised in Delaware, with blackberries and dewberries ranking next. In 1899, the acreage of strawberries was 6,344; in 1909 this acreage had increased to 7,194 and the production was 12,730,265 quarts, valued at \$569,354. In the period from 1899 to 1909, the acreage of blackberries and dewberries decreased from 2,935 to 1,256. The production in 1909 was 1,403,977 quarts, valued at \$61,817. In 1909, there were also produced 275,871 quarts of raspberries and loganberries, valued at \$17,359; 12,123 quarts of gooseberries, valued at \$908; and 2,973 quarts of currants, valued at \$294.

Of the vegetables produced, potatoes and sweet potatoes were the most important individual vegetables. In 1909, from a reported acreage of 9,703, there were harvested 880,360 bushels of potatoes, valued at \$453,400. In the same year, the production of sweet potatoes and yams from 5,229 acres was 733,746 bushels, valued at \$276,679. The value of tomatoes produced from an acreage of 13,108, in 1909, was \$583,639. Other vegetables produced in Delaware, their acreage, and the value of the products in 1909, follow: asparagus, 410 acres, value of product \$39,097; cantaloupes and muskmelons, 1,163 acres, value of product \$52,228; celery, 44 acres, value of product \$12,394; sweet corn, 1,341 acres, value of product \$35,073; green peas, 1,234 acres, value of product \$42,780; watermelons, 859 acres, value of the product \$26,343.

The growing of flowers and plants is quite an important industry in Delaware. In 1909, the value of the production from 44 acres was \$71,429. The area covered by glass in 1909 was 244,827 square feet, of which 233,087 were covered by greenhouses and 11,740 by sashes and frames.

Concerning nursery products, the acreage increased 4.6 per cent from 1899 to 1909 or from 174 acres to 182 acres. The increase in the value of the nursery products for the same period increased 126.5 per cent, the value being given as \$17,241 in 1899 and \$39,057 in 1909.

C. A. McCUE.

Maryland.

Maryland (Fig. 2509) consists naturally of three distinct regions known as: (1) the coastal plain; (2) the Piedmont region, or plateau; (3) the Appalachian region. The coastal plain rests on both shores of the Chesapeake Bay. The portion lying between the Bay and the ocean is known as the Eastern Shore. It is generally level, of low elevation and deeply indented with bays and estuaries. This portion west of the Bay becomes hilly as it recedes from the shore and approaches the Piedmont plateau. Its western boundary is approximately indicated by the Potomac River to Washington, and the Baltimore and Ohio Railroad as it passes from Washington through Baltimore to Wilmington.

The Piedmont plateau extends westward from the coastal plain to the base of the Catoctin Mountains in Frederick County. It is traversed by several ranges of hills. Some of these are of considerable height.

The Appalachian region forms the western part of Maryland and may be divided into three districts. The first or eastern part commences at the foot of the Catoctin Mountains. It is traversed by a number of ranges forming the Great Valley and the famous Middletown Valley noted for its beautiful landscape, fertile soil, and prosperous farms. The central district of this region is bounded on the east by North Mountain, and on the west by Willis Mountain near Cumberland. It is traversed by various intermediate ridges and comprises the greater part of Washington and Allegany counties. It is upon the slopes of these mountains that the largest and most extensive commercial orchards of the state are found. The western district contains the Allegany plateau and extends to the western boundary of the state. It contains a portion of Allegany County and all of Garrett County. It contains the great divide, from which the water runs partly to the Atlantic by way of the Potomac and partly to the Gulf of Mexico by way of the Monongahela, Ohio, and Mississippi.

The climate of Maryland varies in the different physical regions just described. Over the coastal plain the winters are short and mild. The snowfall is light and of short duration. The region is noted for its long growing season. In the Piedmont region the summers are cooler and the winters more severe, though severe weather seldom begins before January. In the Appalachian region the climate is more severe than in the other regions. The winters set in earlier and the snowfall is generally heavy.

The mean temperatures during January and June for the various sections are as follows: coastal plain, 35° and 73.5°; northern central, 30.7° and 72.8°; western Maryland, 30.5° and 70.3°; all Maryland, 32.8° and 72.5°.

Occasionally greater extremes are encountered than these figures would indicate. Sometimes the mercury goes to 98° or 100° in summer, and in winter a cold wave may cause it to drop below zero, but these extremes are of short duration.

Along the Atlantic coast and the shores of Chesapeake Bay, frosts do not occur between about April 5 and November 10, giving a period of safe plant growth of about 210 days. The length of this period decreases rapidly as the distance from the shore increases. In the central parts of the "peninsula" of the Eastern Shore, frosts do not disappear until about April 15, and reappear about October 22, giving a safe growth period of 190 days. On the western or windward side of the Blue Ridge Mountains, the frost-period extends into the first week of May and reappears in the fall about the first week in October, giving a safe growth period of about 160 days.

In Garrett County, forming the western part of the Appalachian region lying at 2,500 to 3,000 feet above sea-level, there is a marked shortening of the growth-

period. Here injurious frosts extend into the early days of June and again set in about the middle of September. This gives only about 100 days of safe plant growth for the season in this region. Along the waters of Chesapeake Bay, in southern Maryland, the period of safe growth is more than again as long.

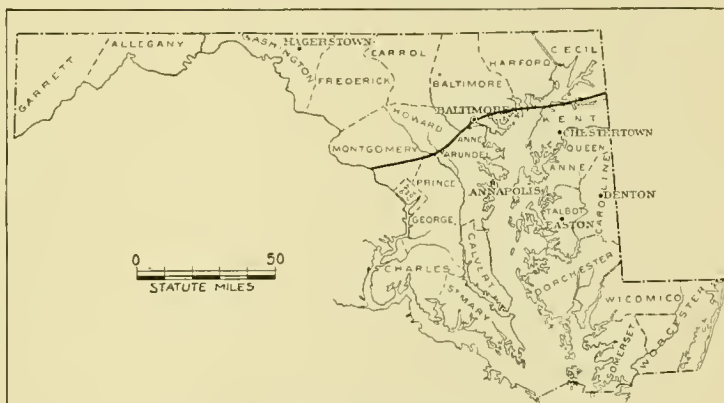
Over the coastal plain, the land is mostly light and largely dominated by the sassafras series of soils. The lighter of these soils are well adapted to early truck crops, while on their heavier sandy and gravelly loams peaches and apples thrive. In the northern tier of counties the soils are heavier and the agricultural interests are more diversified. The mountain slopes are well adapted to fruit-growing.

The transportation facilities, both land and water, are unsurpassed. Chesapeake Bay, with its numerous long, broad, navigable tributaries ramifying all parts of the state, gives Maryland a water-frontage larger than that of any other equal area. A large fleet of vessels is kept busy carrying produce from bay and river ports to Baltimore, Philadelphia, Washington, and other markets. Maryland is well supplied with railroads. Six distinct lines enter Baltimore. There are also a number of electric lines that carry freight. The Maryland State Roads Commission maintains an excellent system of state roads.

Climate, soil, transportation facilities with large markets near at hand, combine most efficiently to make Maryland a great horticultural region. Although small in area, it enjoys a remarkable range of soil and climatic conditions and because of this great range all of the horticultural products of the eastern United States can be grown with ease. In the entire region south of Baltimore, the growing of vegetables has assumed large proportions. The tomato is the most extensively grown vegetable crop of the state. In the production of tomatoes Maryland leads all other states. Potatoes, sweet corn, sweet potatoes, peas, cantaloupes, cabbage, beans and watermelons follow in the order named. Baltimore County leads in the production of early potatoes. Recently a rapidly increasing late potato area has developed in the higher altitudes of Garrett and Allegany counties. This region produces an excellent "seed" potato which has been found fully equal to the Maine-grown seed potatoes. These potatoes are now displacing the Maine-grown potatoes for planting purposes in the warmer regions of the state. Most of the sweet potatoes are grown on the light, warm, sandy soils of Anne Arundel County, although they are grown to some extent in every county of the state. Maryland ranks third in the Union in the production of spinach, green peas, and sweet corn, and sixth in the production of green beans and cantaloupes.

Strawberries stand out conspicuously among the small-fruit productions of Maryland. In the production of strawberries Maryland outranks every state in the Union, producing in 1909 nearly 30 per cent of all the strawberries grown in the United States. Strawberries thrive over the entire state but are most extensively grown in Anne Arundel, Wicomico, Somerset, Worcester and Caroline counties. In these counties, strawberries are produced in enormous quantities and during the picking season, which begins about May 12, special trains from these regions carry Maryland strawberries as far west as Chicago, and as far north as Montreal and Quebec. Anne Arundel also led in the production of blackberries and dewberries in 1909, but of late years the production of bush-fruits has been greatly on the increase in Washington and Allegany counties.

Maryland has long been famous as a peach-producing region. The first commercial orchard in the state was planted in 1800, in Anne Arundel County, 20 miles from Baltimore. The orchard was owned by Thomas Robinson. It contained 20,000 trees, and proved highly profitable. Other orchards soon followed; and soon peaches were grown on a large scale in Anne Arundel County. It is not known just when the first orchard was planted on the Eastern Shore. In 1830, a Major Philip Reybold planted an orchard of 6,000 trees in Kent County, and in the same year a Mr. Cassidy planted 50,000 trees along the Sassafras River in Cecil County. Under the influence of the congenial soil and climate, with practically no enemies to contend with, the industry flourished and by 1865 the water fronts of Cecil, Kent, and Queen Anne counties presented the appearance of a continuous peach forest, extending inward for several miles. The peach industry of western Maryland is of comparatively recent origin. John A. Nicodemus planted the first orchard at Edgemont, in Washington County, and his orchard became the cradle of the industry in which many beginners received their first lessons in peach-growing. W. D. Hues also planted



2509. Maryland, with the line of demarcation.

an orchard of 300 trees on the Blue Ridge Mountains, near Keedysville, in 1880. Keedysville is now a large shipping point for peaches. The first orchards were planted on the Blue Ridge; gradually they spread to lower levels and other ridges. The higher elevations, however, are considered the more desirable, as on the lower levels the crop is more frequently ruined by frosts.

This is a brief outline of the beginning of the peach industry in Maryland. For many years it dominated the fruit industry of the state. The comparative ease with which peaches were grown led many ambitious growers to plant larger areas than they could properly manage, and with the advent of the San José scale and the yellows, peach-curl borers, and other pests, many growers were forced to curtail their operations. This was more noticeable on the Eastern Shore than in western Maryland, where the plantings were more conservative and the orchards, on the whole, better managed. On the Eastern Shore, peaches were largely superseded by vegetable crops. At first, the cause of failure was attributed to a change in climatic conditions. This, however, is not the case, for under proper management and scientific methods peaches can now be grown on the Eastern Shore as well as formerly. Through the activities of the State Horticultural Department, in connection with the State Agricultural College, the growers have learned to overcome the inroads of scale, yellows, brown-rot, and other pests; and, since 1900, the planting out of peach, as well as other fruit-trees, has been on the increase. The following are among the leading commercial varieties grown: Greensboro, Carman,

Mountain Rose, Champion, Elberta, Belle of Georgia, Heath Free, Reeves, Oldmixon, Chairs, Fox Seedling, Pickett Late, Stevens, Salway and Bilyeu.

The natural conditions for the production of apples are unsurpassed and the apple industry is growing steadily. On the Eastern Shore the early summer varieties thrive. Ripening as they do in June and early July, they bring high prices in the northern markets. The northern tier of counties have soil and climatic conditions favorable to the production of fall and winter varieties of the highest quality. Because of the great range of climate, a long list of varieties is available to select from. In western Maryland the best northern varieties like Spy, Tompkins King, Baldwin and Rhode Island Greening thrive on the higher elevations, while such excellent varieties as Grimes Golden, Jonathan, Winesap, Stayman Winesap, Paragon, Nero and Delicious can be grown to perfection in practically all parts of the state. At the present time the largest number of bearing trees are Ben Davis and York Imperial, but the planting out of these varieties has practically ceased. The present plantings are mostly Grimes, Jonathan Stayman, Winesap and Delicious. These varieties will soon be produced in large quantities. During the past ten years, large tracts of wild mountain land, considered worthless for agricultural purposes, have been converted into orchards. Some of these newly planted orchards are of considerable size. Near Cumberland on the Green Ridge Mountains and overlooking the Potomac River is probably located the largest single orchard project in the world. This project is converting 40,000 acres of wild mountain land into an apple orchard. Over 1,000,000 trees are already planted and the first plantings are now in bearing. This entire tract contains only three varieties, namely, Grimes, Jonathan, and Stayman Winesap. The largest full bearing apple orchard in the state is located near Hancock, in Washington County, and contains 900 acres. Orchards containing several hundred acres are common in this section. A large number of these newly planted apple orchards contain peaches as fillers.

Pears thrive throughout the state, and the planting of pear orchards has been on the increase. Kent and Anne Arundel counties lead in this industry.

Plums are grown only to a limited extent. They can be grown with ease but the other fruits are more profitable. Those grown are mostly of the Japanese and Wild Goose type. The production of sour cherries is on the increase.

In the production of grapes, Prince George's County leads. The production of grapes is steadily increasing throughout the state. Grapes ripen here at a time when the southern-grown grapes are off the market and before the northern grapes come on. The leading commercial varieties grown are: Moore Early, Concord, Niagara and Delaware. Besides these, Campbell Early, Lutie, Worden, Woodruff Red and Catawba are also grown in appreciable quantities.

The large fruit and vegetable industries have given rise to another large industry, namely, canning and preserving. According to the Twelfth Census, there were 468 such establishments, in 1909, turning out a product valued at \$13,709,449. Of this amount, \$12,538,862 was vegetables and fruits. Several of the larger plants continue to operate as fish and oyster canneries when the fruit and vegetable season is over. In canning, Maryland leads the other states. The tomato is the chief item. According to statistics compiled by the National Canners' Association, Maryland canned 41.6 per cent of all the tomatoes canned in the United States from 1908 to 1914.

The long growing season and the deep mellow soils make Maryland well adapted to production of nursery products. In 1914 there were fifty-two such establishments inspected by the State Horticultural Department. Most of these are small and are operated in

connection with other farming operations. The number fluctuates from year to year. Some farmers grow a nursery crop only occasionally. The largest nursery in the state is located near Berlin, in Worcester County, and covers a tract of 2,500 acres devoted chiefly to the production of nursery products, fruit trees being the chief output. The second largest nursery is located near Baltimore and contains 1,200 acres.

Maryland abounds in beautiful scenery. The vicinity of Baltimore is surrounded by charming suburbs, beautifully landscaped and planted with trees, shrubs and flowers. Druid Hill Park, laid out by the Olmsted brothers, is one of the finest parks in the United States. The Green Spring Valley, north of Baltimore, is noted for its magnificent country homes and large estates.

One of the most influential horticulturists of Maryland was J. W. Kerr, a sketch of whose life will be found in volume III, page 1582.

Public-service agencies for horticulture.

The Maryland Agricultural College was established as a private institution in 1856, and opened for instruction in 1859. After Congress passed the Land-Grant Act in 1862 the General Assembly of Maryland formally accepted the grant and the Maryland Agricultural College was named as beneficiary. This made the College in part a state institution, and in the fall of 1914 it was entirely taken over by the state. The Agricultural College and Experiment Station are located at College Park. There are ten men on the staff of the College and Experiment Station devoting themselves to horticultural work.

Maryland has two horticultural societies; namely, the Peninsula Horticultural Society, founded in 1886, and the Maryland State Horticultural Society, founded in 1898. The object of both these societies is the promotion of horticulture in all its branches. Both societies receive some state aid. The Peninsula Society is primarily intended for residents of Delaware and the Eastern Shore of Maryland.

Statistics (Thirteenth Census).

The approximate land area of Maryland in 1910 was 6,362,240 acres. The land in farms numbered 5,057,140 acres, which was 79.5 per cent of the land area. Of the land in farms, 3,354,767 acres were improved; 1,467,333 acres were in woodland; and 235,040 acres were other unimproved land in farms. The number of all the farms in 1910 was 48,923. The average acreage to a farm was 103.4. [The total area is 12,327 square miles.]

The leading agricultural crops of Maryland are cereals, hay and forage, forest products of the farms and tobacco. The acreage of cereals in 1909 was 1,329,201, and the value of the products \$21,908,730, which was 49.9 per cent of the total value of all crops. The acreage of hay and forage increased from 374,848 in 1899 to 398,842 in 1909, when the products were valued at \$6,011,749, which was 13.7 per cent of the total value of all crops. The value of the forest products of the farms increased from \$1,170,362 in 1899 to \$2,349,045 in 1909. The acreage of tobacco in 1909 was 26,072, and the value of the production, \$1,457,112.

Horticultural crops grown in Maryland are fruits and nuts, small-fruits, flowers and plants and nursery products, and vegetables. The value of the fruits and nuts produced in 1909 was \$1,577,978, as compared with \$1,311,386 in 1899. Small-fruits decreased in acreage from 17,522 in 1899 to 16,595 in 1909, when the value of the products was \$1,227,548. In 1909 the total acreage of potatoes and other vegetables was 155,339, and their value \$7,996,105. In 1899 the acreage was 133,344. Flowers and plants and nursery products increased in acreage from 1,449 in 1899 to 4,718 in 1909, an increase of 225.6 per cent, when the value was \$1,053,901.

The total quantity of orchard fruits produced in 1909 was 2,577,359 bushels, valued at \$1,517,400. Apples

contributed nearly three-fourths of this quantity and pears, and peaches and nectarines most of the remainder. The apple trees of bearing age in 1910 numbered 1,288,482; those not of bearing age, 660,685. The apple-production in 1909 was 1,822,824 bushels, valued at \$902,077. The peach and nectarine trees of bearing age in 1910 numbered 1,497,724; those not of bearing age 805,063. The production in 1909 was 324,609 bushels, valued at \$361,617. Pear trees of bearing age in 1910 numbered 540,583; those not of bearing age 138,152. The production in 1909 was 367,359 bushels, valued at \$168,561. In addition, there were produced in 1909, 42,315 bushels of cherries, valued at \$60,121; 13,526 bushels of plums and prunes, valued at \$16,192; 6,359 bushels of quinces, valued at \$8,383; and 365 bushels of apricots, valued at \$448.

The production of grapes is not of marked importance. In 1910 the grape-vines of bearing age numbered 138,801; those not of bearing age 44,690. The production in 1909 was 2,152,382 pounds, valued at \$53,498.

The total production of nuts in 1909 was 318,148 pounds, valued at \$5,687. Black walnuts and chestnuts contributed the greater part of this amount, the production of black walnuts in 1909 being 274,936 pounds, valued at \$2,997; that of chestnuts, 24,842 pounds, valued at \$1,439. There were also produced in 1909, 6,916 pounds of Persian or English walnuts, valued at \$745; and 1,717 pounds of pecans, valued at \$85.

Strawberries are the most important of the small-fruits, with blackberries and dewberries next in importance. The acreage of strawberries increased from 13,980 in 1899 to 14,292 in 1909, when the production was 23,611,095 quarts, valued at \$1,070,072. In the same period the acreage of blackberries and dewberries decreased from 1,501 in 1899 to 1,180 in 1909, when the production was 1,372,164 quarts, valued at \$68,817. The acreage of raspberries and loganberries decreased from 1,385 in 1899 to 846 in 1909 when the production was 959,369 quarts, valued at \$67,516. There were also produced in 1909, 300,321 quarts of gooseberries, valued at \$18,000; and 34,009 quarts of currants, valued at \$3,138.

The tomato holds first place among the vegetables grown in Maryland. In 1909, it covered an area of 42,721 acres, and was valued at \$2,037,634. Potatoes, sweet potatoes and yams are next in importance. The acreage of potatoes increased from 26,472 in 1899 to 39,299 in 1909, when the production was 3,444,311 bushels, valued at \$1,782,954. The acreage of sweet potatoes and yams increased from 6,469 in 1899 to 7,956 in 1909, when the production was 1,065,956 bushels, valued at \$483,751. Of the other vegetables produced in 1909, the more important were: 18,387 acres of sweet corn, valued at \$386,277; 3,481 acres of cabbage, valued at \$304,394; 3,516 acres of cantaloupes and muskmelons, valued at \$246,333; 6,030 acres of green peas, valued at 220,709; 2,746 acres of green beans, valued at \$153,013; 2,432 acres of watermelons, valued at \$94,737; and 1,314 acres of spinach, valued at \$80,653. Vegetables of lesser importance were asparagus, beets, cauliflower, celery, cucumbers, eggplant, horseradish, kale, lettuce, onions, parsnips, radishes, rhubarb and turnips.

The acreage devoted to the production of flowers and plants increased from 174 in 1899 to 478 in 1909, an increase of 174.7 per cent. The total area of land under glass in 1909 was 2,175,584 square feet, of which 2,051,068 were covered by greenhouses, and 124,516 by sashes and frames. The value of the flowers and plants produced in 1909 was \$597,001, as compared with \$355,862 in 1899.

The acreage of nursery products increased from 1,275 in 1899 to 4,240 in 1909, an increase of 232.5 per cent. In 1909 the value of the nursery products was \$456,900, as compared with \$123,474 in 1899.

HERMAN BECKENSTRATER.

Virginia.

The state of Virginia (Fig. 2510) comprises six main physical or natural divisions known as the Tidewater, Middle, Piedmont, Blue Ridge, Valley and Appalachian regions. Each of these divisions has its own soil types and to a less extent its peculiarities of climate. These divisions consist of parallel belts of territory of the same general direction as the Alleghany Mountains.

The Tidewater division extends from the seashore to the head of tide and comprises about 11,350 square miles of territory. The highest elevation within this division is not more than 200 feet above sea-level. This district is traversed by numerous navigable rivers and its shores are indented by many estuaries and bays. The soil in this section is mostly drift from the more elevated part of the state and is usually light and easy to work. The climate is mild and somewhat more equable than the more inland sections of the state. The cheap transportation facilities furnished by the navigable waters, together with the mild climate and light soil of this section, has led to the development of truck-farming on an extensive scale. This constitutes the chief agricultural industry of the division. Parts of the three great truck regions of the Atlantic seaboard lie within this division of the state, namely, the Norfolk, Baltimore and Peninsula districts.

Middle Virginia is geologically the oldest region of the state and comprises 12,470 square miles of territory. It is, on the whole, more elevated than Tidewater but seldom exceeds an elevation of more than 500 feet. Horticultural crops are not extensively grown. Tobacco is the main crop, while corn and wheat succeed on the best types of soil. Bush-fruits do well in many parts of this district, while sections favored by good soil and proper elevation will produce good tree-fruits.

The Piedmont division of Virginia lies at the foot of the Blue Ridge and consists of a long, narrow belt of land varying in width from 30 to 40 miles and extending from the northern to the southern boundary of the state. It comprises 8,680 square miles of territory. The major part of this division varies in elevation from 500 to 1,000 feet above sea-level, although some of the detached mountain spurs lying within this district are much higher. The soils of Piedmont are highly variable but on the whole are well adapted to fruit-growing and grain-farming, while in the northern part of Piedmont, grazing is made possible by the presence of limestone soils and the natural growth of blue-grass.

The Blue Ridge division comprises the narrow range of the Blue Ridge Mountains. This division has a total area of 1,230 square miles. The northern two-thirds is rough and precipitous except in the mountain passes or gaps. The southern part, however, consists of a broad elevated tableland and includes the counties of Floyd, Carroll and Grayson. The soil of this part of the Blue Ridge section is not very different from that of Piedmont. Fruit-growing throughout the northern part of this section is confined largely to the mountain gaps and is of the same general character as that of Piedmont. Fruit-growing has not been extensively developed in the southern part of this section, owing to lack of proper transportation facilities. When this difficulty is met, there is likely to be a development in growing winter apples on a large scale, because of its high elevation.

The Valley section of the state lies northwest of the Blue Ridge and comprises a total area of 7,530 square miles. This is the best grain-growing section of the state. However, certain soils in this section are particularly adapted to the growing of apples and other fruits, and the development of commercial orcharding has been on a rather large scale. Frederick County, in the northern part of this valley, grows more fruit than any other one county in the state. Good fruit-land is to be found throughout this great valley. This division is divided

into five subdivisions or minor sections by cross spurs which extend from the Blue Ridge to the Alleghany Mountains. Each of these minor divisions has its own particular types of soil. That part of the valley where fruit-growing is most highly developed extends from Staunton to the Potomac River. The part of this section which is drained by the waters of the Roanoke River appears to be especially adapted to canning crops. Botetourt County is noted for this industry. In the southwest, on the elevated land which divides the Holstein River district from the New River district, one will find large areas devoted to the growth of cabbage. The soil and climate of this elevated part of the valley seems admirably adapted to the production of this crop. The Valley division, as a whole, promises important development in fruit-growing and other horticultural industries.

The section of the state known as Appalachia lies to the northwest of the Valley and comprises a total area of about 5,700 square miles, consisting of large mountain ranges and narrow deep valleys. This part of the state is generally regarded as a grazing section, although there is much good apple and peach land to be found on the cross spurs and mountain slopes. Wherever good transportation facilities exist, profitable orchards are found. Much of this territory, however, remains undeveloped because of its inaccessibility.

The leading horticultural industries of the state are trucking and apple-growing. The Norfolk, Baltimore and Peninsula areas are especially adapted to the growth of truck crops and the development of trucking in this region has been on a large scale. Fruit-growing has been largely developed in the Piedmont, Blue Ridge and Valley sections of the state, while special phases of trucking have been developed in parts of the Valley section. Appalachia also offers good opportunities for fruit-grow-

The leading varieties of commercial apples are York Imperial, Winesap, Ben Davis, Albemarle (Yellow Newtown), Arkansas, Grimes and Stayman Winesap.

The peach has long been regarded as an important fruit crop in Virginia, but it is only within recent years that its culture has assumed large proportions. At the present time the bulk of the peaches produced in this state is harvested from commercial plantings. The crop ripens in Virginia soon after the main crop of more southern districts is off the market, and is slightly ahead of the large orchards of West Virginia and Maryland. The peach grows to perfection throughout the state, wherever the frost factor can be safely ignored. The leading commercial varieties of this fruit are Carman, Hiley, Early Crawford, Elberta, Late Crawford, Smock, White Heath, and Bilyeu. The Elberta is planted more extensively than any other variety.

Other fruits, including the cherry, plum and grape, are important in certain restricted locations, but their cultivation is not general. Pear orchards have very generally proved unprofitable on account of the ravages of fire blight.

Small-fruits are grown in many parts of the state for local market, but their production with reference to northern markets is limited except in case of the strawberry, which is grown extensively in the trucking regions of the state and constitutes one of the most important sources of revenue.

Among the truck crops grown in the state, the potato sweet-potato and salad are the most important. The potato is grown almost entirely as a truck crop in Virginia, that is, early varieties are chiefly used and the crop is harvested before it is fully matured. Large areas in the Norfolk and Peninsular districts are utilized in the production of potatoes. The eastern part of the state is ideally adapted to the growth of this plant as a truck crop. In the western part of the state the potato is grown to some extent as a field crop, but this type of potato-growing is not extensive. A few localities with high altitude grow potatoes to supply the truck-farmers with tubers for seeding. When grown for this purpose the crop has generally proved rather profitable.

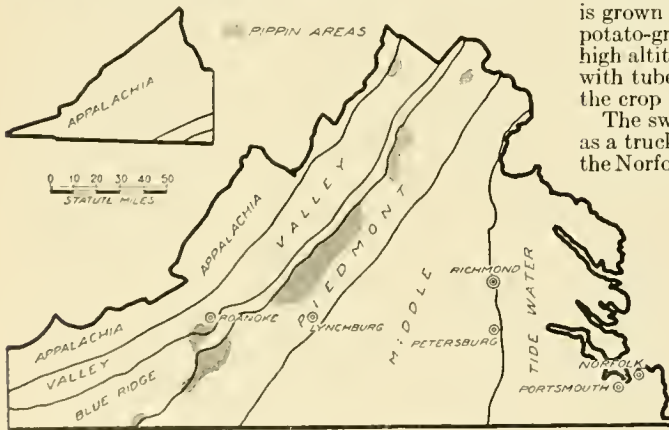
The sweet potato is next in importance to the potato as a truck crop. The great bulk of this crop is grown in the Norfolk and Peninsular areas. Sweet potatoes are not grown outside of Tidewater except in a small way for local market and for home use.

In addition to the crops mentioned above, other leading crops can be classed under one head as salads or pot-herbs. Spinach, kale, and lettuce are all grown on an extensive scale in the Norfolk district. Many growers confine their efforts largely to these crops. The profits are not great some years, but the grower who sticks to these crops year after year usually makes handsome profits in the long run.

Cabbage is another important truck crop of Virginia. It is grown for early market in the region around Norfolk, while it is grown very extensively for both early and winter markets in southwest Virginia. It constitutes the chief money crops in certain parts of Smyth and Wythe counties where it is grown on a large scale as a field crop.

The tomato is a very important crop in certain parts of the state. While it is grown extensively for general market in the principal trucking districts of the state, it is not a dominant crop in these sections. It becomes of primary importance in the canning districts, particularly in certain parts of Botetourt and Bedford counties, where the canning industry is firmly established.

In addition to trucking and apple-growing, which are the chief horticultural industries, grape-growing, small-fruit-culture and the nursery business have each received their share of attention. Grape-growing was once a thriving industry in the Charlottesville section



2510. Virginia, with the main geographical divisions.

ing, but the development of the industry there has not been rapid on account of the lack of good transportation facilities.

The apple is the most important fruit crop of the state. Although this fruit has been grown commercially since colonial times, it is only in more recent years that the industry has assumed considerable proportions. Heavy plantings have been made during the last two decades and the annual yield of this crop is rapidly increasing. The apple succeeds on a commercial scale in the four western divisions of the state. Important apple-growing areas are to be found throughout Piedmont, while in many parts of the Valley and Appalachia it is extensively grown. The plantings in the eastern part of the state are primarily for home supply, but there is no reason why many localities in this part of Virginia cannot produce summer apples on a commercial scale.

of Piedmont but the industry has languished in recent years. It has been fully demonstrated, however, that the growing of table grapes is profitable in many parts of the state. There are several large nurseries and many small ones located in the state. Taken as a whole, the nursery business is of considerable importance. The state, also, has a number of large seed-houses and the growing of pedigreed seed is now important. The cut-flower industry has assumed considerable proportions near the large cities, while the same may be said for the forcing industry.

The development of fine country estates belongs chiefly to Colonial and ante-bellum days. However, many of these old estates have been preserved for the present generation, among which may be mentioned, Mount Vernon, Monticello and Montpelier. Throughout the state may be found less noted establishments which are, nevertheless, prized for their beauty.

The history of horticulture in Virginia is meagre. Beyond the fact that fruits and flowers have been prized from Colonial days, little is known of the evolution of the present horticultural industries. The strictly commercial phases of horticultural development are recent or are yet in their infancy.

Public-service agencies for horticulture.

The land-grant college of Virginia, known as the Virginia Polytechnic Institute, is located at Blacksburg in the southwestern part of the state. The State Experiment Station is a department of the College. The staff of the horticultural department consists of four horticulturists.

The inspection work for orchards and nurseries is administered by the Crop Pest Commission, which is directed by the same board as the Experiment Station. This office is essentially a department of the Agricultural College. Three trained officers devote practically their entire time to this work. There are also a large number of county inspectors engaged in orchard and nursery inspection under the direction of the Commission.

The Virginia State Horticultural Society is one of the influential agricultural associations of the state.

A Truck Experiment Station was organized in 1907 and located in the trucking district near Norfolk. This Station is supported and controlled conjointly by the United States Department of Agriculture, the Virginia Experiment Station, the State Department of Agriculture and the Southern Produce Exchange. Much valuable experimental and research work has already been carried out for the benefit of the trucking industry.

The State Department of Agriculture has its headquarters at Richmond, and devotes a considerable part of its efforts to the fruit-growing and trucking industries.

Statistics (Thirteenth Census).

The approximate land area of Virginia in 1910 was 25,767,680 acres. The land in farms was 75.7 per cent of the land area, or 19,495,636 acres. Of this land in farms, the improved land numbered 9,870,058 acres; the woodland, 8,414,680 acres; and other unimproved land in farms, 1,210,898 acres. The total number of farms in the state in 1910 was 184,018, and the average acreage to a farm, 105.9. [The total area of the state is 42,627 square miles.]

The leading agricultural crops of the state are cereals, tobacco, and hay and forage. The acreage devoted to the production of cereals decreased from 3,166,332 in 1899 to 2,841,114 in 1909, when the production was valued at \$39,993,929, which was 39.8 per cent of the total value of all crops. Tobacco increased in acreage from 184,334 in 1899 to 185,427 in 1909, when the production was valued at \$12,169,086. Hay and forage increased from 612,962 in 1899 to 773,577 in 1909, when the production was valued at \$10,256,998. Forest

products of the farms were valued at \$10,118,851 in 1909, as compared with \$3,797,116 in 1899.

Horticultural crops grown in Virginia are fruits and nuts, small-fruits, vegetables, including potatoes and sweet potatoes and yams, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$3,770,491, as compared with \$2,755,487 in 1899. Small-fruits decreased in acreage from 8,796 in 1899 to 7,295 in 1909, when the production was 11,342,980 quarts, valued at \$671,843. The total acreage of potatoes and other vegetables in 1909 was 252,119, and their value, \$17,338,496. Excluding potatoes, and sweet potatoes and yams, the acreage of the other vegetables increased from 99,002 in 1899 to 124,354 in 1909, when the production was valued at \$8,989,467. Peanuts increased in acreage from 116,914 in 1899 to 145,213 in 1909, when the production was 4,284,340 bushels, valued at \$4,239,832. Flowers and plants and nursery products decreased in acreage from 1,343 in 1899 to 944 in 1909, when the production was valued at \$522,480.

The total production of orchard-fruits in 1909 was 6,581,101 bushels, valued at \$3,582,359. Apples contributed more than nine-tenths of this quantity, peaches and nectarines and cherries most of the remainder. The apple trees of bearing age in 1910 numbered 7,004,548; those not of bearing age, 3,435,591, and the production in 1909 was 6,103,941 bushels, valued at \$3,129,832. Peach and nectarine trees of bearing age in 1910 numbered 1,585,505; those not of bearing age, 780,551. The production of peaches and nectarines in 1909 was 243,446 bushels, valued at \$227,141. Cherry trees of bearing age in 1910 numbered 352,783; those not of bearing age, 83,323. The production in 1909 was 132,671 bushels of cherries, valued at \$134,428. The production of other orchard-fruits in 1909 was: 74,486 bushels of pears, valued at \$63,424; 22,597 bushels of plums and prunes, valued at \$22,772; 3,443 bushels of quinces, valued at \$4,037; and 515 bushels of apricots, valued at \$723.

The production of grapes in 1909 was 4,108,694 pounds, as compared with 3,608,903 pounds, the production in 1899. The value of the grapes produced in 1909 was \$156,266. The vines of bearing age in 1910 numbered 424,701; those not of bearing age, 136,026.

The production of nuts was 841,572 pounds, valued at \$22,161. The nuts produced in 1909 were: 600,141 pounds of black walnuts, valued at \$9,723; 210,364 pounds of chestnuts, valued at \$9,686; 10,568 pounds of pecans, valued at \$1,356; and 22,512 pounds of Persian or English walnuts, valued at \$1,231.

Figs were the only tropical fruit of importance in 1909, the production being 234,057 pounds, valued at \$9,652.

Strawberries are the most important of the small-fruits, with blackberries and dewberries ranking second in quantity and third in value, while raspberries and loganberries are third in quantity, but second in value. The acreage of strawberries decreased from 7,821 in 1899 to 6,606 in 1909, when the production was 10,761,381 quarts, valued at \$626,649. Blackberries and dewberries decreased in acreage from 444 in 1899 to 344 in 1909, when the production was 273,551 quarts, valued at \$16,485. Raspberries and loganberries decreased in acreage from 365 in 1899 to 276 in 1909, when the production was 257,322 quarts, valued at \$24,853. Other small-fruits were: 23,447 quarts of gooseberries, valued at \$1,909; 18,112 quarts of cranberries, valued at \$1,050; and 8,127 quarts of currants, valued at \$791.

The potatoes and sweet potatoes and yams rank far ahead of the other vegetables in importance. Potatoes increased in acreage from 51,021 in 1899 to 86,927 in 1909, when the production was 8,770,778 bushels, valued at \$5,667,557. Sweet potatoes and yams increased in acreage from 40,681 in 1899 to 40,838 in 1909, when the production was 5,270,202 bushels, valued at \$2,681,472. Other vegetables of importance

were: 11,965 acres of tomatoes, valued at \$495,773; 3,058 acres of spinach, valued at \$489,170; 8,080 acres of cabbage, valued at \$187,334; 1,766 acres of cucumbers, valued at \$177,254; 2,867 acres of green beans, valued at \$167,199; 3,159 acres of watermelons, valued at \$136,898; 1,013 acres of kale, valued at \$115,658; 969 acres of cantaloupes and muskmelons, valued at \$83,108; 2,101 acres of sweet corn, valued at \$73,050; and 787 acres of onions, valued at \$59,524. Vegetables, the value of which was between \$10,000 and \$50,000, are as follows: asparagus, \$31,205; eggplant, \$20,430; lettuce, \$24,187; radishes, \$19,842; and turnips, \$22,582. Vegetables of less importance are beets, parsley, pumpkins, rhubarb, rutabagas, and squash.

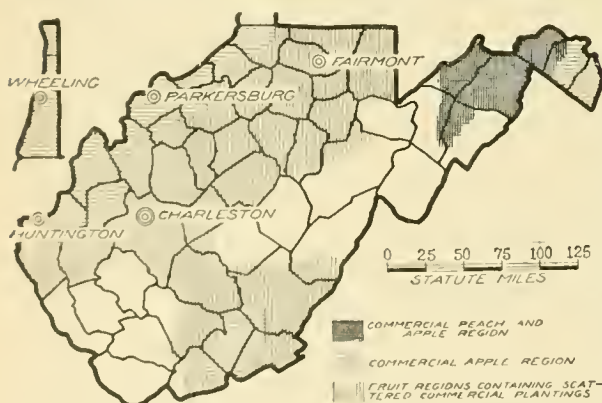
The acreage devoted to the production of flowers and plants increased from 143 in 1899 to 375 in 1909. The area under glass in 1909 was 1,413,170 square feet, of which 1,315,388 were covered by greenhouses, and 97,782 by sashes and frames. The value of the flowers and plants produced in 1909 was \$362,488, as compared with \$238,712 in 1899.

Nursery products decreased in acreage from 1,200 in 1899 to 569 in 1909, when the production was valued at \$159,992, as compared with \$214,988, the value in 1899.

H. L. PRICE.

West Virginia.

From a horticultural standpoint, West Virginia (Fig. 2511) presents many unique features and undeveloped possibilities. From the crest of the Alleghany Mountains to the waters of the Shenandoah River on the east and the Ohio River on the west, there is a difference in elevation of about 4,000 feet. The effect of this range in elevation is to furnish a climate with as much variation as might normally be found between



2511. West Virginia, showing the regions of horticultural adaptabilities.

Vermont and the Carolinas. As might be expected, the horticultural flora of the state is very extensive and the matter of varietal adaptation is one of great importance. The Baldwin and Northern Spy apples, when grown in Preston County at an elevation of 3,000 feet or more, are similar to the well-known New York and New England product, but when grown in the Shenandoah Valley they attain a very large size, ripen with the early fall varieties, are coarse in texture, poor in quality and can be kept only a few weeks even in storage.

West Virginia has long been known as a producer of coal, oil, gas, and lumber, but in recent years the rapid development of the orchard industry has raised the state to a place of importance among the leading fruit-producing states. The Census report for 1910 indicated that West Virginia ranked twelfth among the states in the production of apples, and the government estimate

for 1914 showed only seven other states exceeding West Virginia in the production of apples for that year. The peach industry is making similar gains, but is less extensive as a whole than the apple industry.

The horticultural industries of the state are unequally divided between fruit-growing and trucking, the former predominating. The leading fruits are the apple and peach, with the cherry forming a poor third. Pears, plums, grapes, and berries are grown in some sections to quite an extent, but the commercial plantings are somewhat scattered and the products are largely sold locally. The commercial apple districts are found in the eastern Panhandle, the northern Panhandle and along the Ohio River, and a small district is located near the southern boundary of the state. This does not mean that these are the only parts of the state producing apples, for scattering commercial orchards, many of them containing 100 acres or more, are found here and there in nearly every county. The peach industry, on the other hand, belongs to six counties of the eastern Panhandle, Hampshire, Mineral, Morgan, Berkeley, Hardie, and Grant. Outside of this region, with the exception of a few orchards along the Ohio River, the industry is purely local. The orchards of the state are all located upon rather rough mountain or hill land, with the exception of those in the Shenandoah Valley, where they are grown upon comparatively level or gently rolling limestone or shale soils.

The varieties of fruit vary somewhat with the section of state in which they are grown. In the Shenandoah Valley the York Imperial has long been the favorite. The "big, red, lopsided apple" finds a ready market in the southern and eastern cities and is also highly esteemed for export purposes. It sometimes scalds badly in storage, and more recent plantings have cut down the proportion of this variety. Next to the York Imperial rank the Ben Davis and its first cousin, the Gano, but these are planted in relatively small numbers at the present time. The Stayman Winesap, Arkansas (Mammoth Black Twig), Grimes, Winesap, Jonathan, Delicious, and Northwestern follow in about the order named. As one ascends the slope of the Alleghany Mountains, the Rome and Baldwin appear, while in the highest altitudes the Baldwin, Tompkins King, Rhode Island, Fallawater, and Northern Spy are found in abundance. Along the Ohio River and, in fact, over the entire western slope of the Alleghany, the Rome finds a home perfectly adapted to its needs and consequently it is a ruling favorite in this whole region. Following the Rome, the other varieties are much the same as are found in the eastern Panhandle. Hancock County, at the northern extremity of the state, is peculiar in that it grows the Willow almost exclusively. This county early developed a system of common storage to which the long-keeping Willow was admirably adapted. The major part of the fruit from this county is placed in cellars, caves, and frame storage houses and is taken out in April and May in first-class condition for market. In the southern part of the state, the Stayman Winesap, Rome, York Imperial, Ben Davis, Grimes, and Jonathan are the best commercial varieties. In none of the regions are summer varieties grown extensively upon a commercial scale, although a few scattered plantings of Yellow Transparent may be found.

The peach industry is confined to a single section and embodies two very general soil types, chert and shale. The former is endowed with more abundant fertility and produces large, heavy-bearing trees. The shale soils require feeding but respond readily to applications of nitrate of soda or manure. The varieties are very much the same in all orchards and consist largely of the following: Carman, Champion, Belle, Elberta, Smock, and Salway.

Peach- and apple-orcharding in West Virginia has developed along extensive rather than intensive lines. Individual growers frequently operate 200 to 300 acres,

while among the corporate holdings, orchards of 500, 600 and even of 1,000 acres may be found. These immense plants call for managerial ability of a high order and present problems involving finance, labor, culture, and marketing which are unknown to smaller growers. Thus far the labor problem has been met by utilizing the local population, but as more and more of the large orchards come into bearing it will be necessary to import many workers, particularly at harvest time. Inasmuch as the local labor is generally unskilled in harvesting and packing, it is the custom to employ experienced professional peach-packers who work northward after the crops are harvested in the more southern states. The barrel is the common package used for apples, but many growers are gradually introducing the box for such varieties as Grimes, Jonathan, Delicious, and Stayman Winesap. Early peaches, such as Carman, Champion, and Belle, are marketed in the Georgia carrier, while the Elberta, Snook, Salway, and other late sorts find a better sale in the Delaware sixteen-quart basket. There is also a tendency now to use the bushel basket for carefully graded late varieties. The methods of selling are unique in that there is a relatively small amount of fruit sold from the orchard or upon the tracks, the greater part being consigned to commission houses.

The trucking industry is at present confined to local areas along the Ohio and Big Kanawha rivers, to some of the "glade" lands on the higher elevations and to a small region in the eastern part of the state. The rich bottoms along the rivers furnish ideal locations for such an industry, while the numerous mining towns afford an almost unlimited market. It seems remarkable that with these advantages more persons have not taken up the work. The principal crops are early potatoes, watermelons, cantaloupes, tomatoes, cabbage, and sweet corn, while to a lesser extent are produced lettuce, spinach, kale, peppers, eggplant, onions, asparagus, and other vegetables usually found in this latitude. In Preston and other counties of a high altitude, where the "glade" lands are located, the midseason and late potatoes are grown. From these regions there has lately developed a promising trade in select seed-potatoes. Seed produced at an altitude of 2,500 or 3,000 feet has been found to equal and in some cases slightly excel the northern-grown seed in vigor and productiveness. This development is of special importance to the southern potato states which have been compelled to secure their seed from such distant points as Wisconsin, Michigan, New York, and Maine.

In the eastern Panhandle and principally in Morgan County, a tomato-growing and canning industry has developed. There are no canneries of great size but the work is done through a number of modest factories and private plants. Many of the orchardists make a practice of intercropping their young orchards for the first three years with tomatoes, thereby aiding materially in reducing the cost of bringing the orchard into bearing. Some of the orchard companies yearly plant from 50 to 100 acres of this crop and operate their own cannery.

As a specialized branch of horticultural industry, the nurseries about Point Pleasant and Mason should be mentioned. The rich loam of the second and third river-bottoms is well adapted to the production of young trees. The apple and peach are the principal fruits propagated, although the other fruits and some ornamentals are grown to a limited extent.

The commercial production of flowers is as yet practically undeveloped. The larger cities and towns are partially supplied by small local florists whose outfits are so small that frequent recourse must be had to outside sources to supply the trade. Coal and gas are plentiful and make a cheap fuel; markets are good and could easily be greatly extended; thus it would seem that a great opportunity is offered for extensive greenhouse development.

No account of West Virginia horticulture would be complete without some mention being made of the native fruits and nuts that abound in all parts of the state. Prominent among these is the native persimmon which may be found growing in all but the higher altitudes. This truly delicious fruit is held in high regard, but strange to say little or no attempt has been made to select and propagate the better strains, although the wild seedlings offer many promising variations. The same may be said of the pawpaw, clumps of which thickly dot the hillsides of the western and southern parts of the state. From early September until freezing weather begins, this aromatic fruit may be found bending the slender bush-like trees to the ground with the weight of its clusters of banana-shaped fruit. While the flavor of the pawpaw is not appreciated by all, it is nevertheless of some economic importance as evidenced by the fact that considerable quantities of the wild fruits are annually gathered and find a ready sale at about 50 cents a bushel. Huckleberries cover whole mountain sides and quickly take possession of forest clearings. Large quantities of this fruit, as well as the blackberry and dewberry, are picked and sold in the local markets. High in the mountain glades one is surprised to find the cranberry growing in abundance. One "cranberry glade" in Pocahontas County has 300 acres of this fruit. From one of the few "cultivated" bogs, fruit was sent to the St. Louis Exposition and won first honors. Thus far little or no attempt has been made to develop the industry. Among the nuts, may be found the chestnut, chinquapin, hickory, and black walnut. While all are relatively abundant, the chestnut is the only one of economic importance for its fruit. These nuts in some sections are gathered in great number and find a ready market. A few years ago several carloads would sometimes be shipped from one point, but now the demand for labor in other lines at that season of the year has cut down the harvest to only a vestige of its former importance.

In considering the men who were prominent in developing the horticultural interests of West Virginia, it is interesting to note that George Washington was one of the first if not the first fruit-grower of any consequence in the state. Records show that on March 18, 1774, he leased to one William Bartlett 125 acres of land "in the barens of Bullsken," a part of the present Berkeley County. The guarantee was "to have and to hold for and during the lives of the said William Bartlett, Mary his wife, and Frederick their son, and the life of the longest liver of them." In addition to £6 annual rent it was agreed that Bartlett should leave a certain area of timber untouched, erect buildings, raise 10 acres of "English grass" and "that within seven years an orchard of one hundred winter apple trees at 40 feet distance every way from each other and that one hundred peach trees shall be planted on some convenient part of the said demised land and the same to be kept always during the continuance of said term, well pruned, fenced in and secured from horses, cattle and other creatures that may hurt, and if any of the said trees shall die, decay or be destroyed that others of the same kind shall be planted in their place, and the entire number thereof be kept up during the said term." Shortly after Washington's venture in the east came an important development in the Northern Panhandle. In 1786, Jacob Nessley purchased a tract of land bordering the Ohio River and cleared and planted 50 acres to apples and peaches. He grew seedling trees for the most part, although it is recorded that he had also some grafted stock. As his crop was devoted to the manufacture of fruit brandies, he was able to utilize the inferior seedlings to good advantage. As the direct result of his influence upon the locality, hundreds of acres of orchards have been planted and the Northern Panhandle grew famous for its production of winter apples. Long the foremost fruit region

of West Virginia, it has only recently been surpassed by the still greater development in the Eastern Panhandle. As Jacob Nesley was the father of commercial fruit-growing in the Northern Panhandle, so was W. S. Miller in the Eastern Panhandle. In 1851, he planted 16 acres of apples, peaches and plums, and the close of the Civil War found him with 4,000 bearing peach trees upon his hands. As time went on the plantings increased until finally the aged pioneer had planted and matured upon his own farm over 4,000 apple and 25,000 peach trees, besides large numbers of plum, pear, quince and cherry trees.

Public-service agencies for horticulture.

The Land-Grant college of West Virginia is located at Morgantown. It was established in 1867 as "The Agricultural College of West Virginia." In 1868, however, this name was changed to "West Virginia University." The College of Agriculture was established in 1897. There are six members of the horticultural staff, who, together with one other man, also make up the horticultural staff of the Experiment Station.

The Experiment Station was established in 1887 at Morgantown as a part of the University.

There is a State Horticultural Society devoted to horticultural interests, with which are affiliated a number of county organizations.

Statistics (Thirteenth Census).

The approximate land area of West Virginia in 1910 was 15,374,080 acres. The land in farms was 65.2 per cent of this area, or 10,026,442 acres. Of this land in farms, the improved land numbered 5,521,757 acres; the woodland, 3,968,836 acres; and other unimproved land in farms, 535,849 acres. The total number of all the farms in 1910 was 96,685, and the average acreage to a farm, 103.7. [The total area of the state is 24,170 square miles.]

The leading agricultural crops are cereals, hay and forage, and tobacco. The acreage devoted to the production of cereals decreased from 1,307,428 in 1899 to 1,038,931 in 1909, when the production was valued at \$15,997,700, or 39.6 per cent of the total value of all crops. Hay and forage increased in acreage from 601,935 in 1899 to 708,900 in 1909, when the production was valued at \$7,492,747, or 18.6 per cent of the total value of all crops. Tobacco increased in acreage from 5,129 in 1899 to 17,928 in 1909, when the production was valued at \$1,923,180. Forest products of the farms in 1909 were valued at \$4,004,484, as compared with \$2,632,980 in 1899.

Horticultural crops produced in West Virginia are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$3,149,122, as compared with \$2,210,871 in 1899. Small-fruits increased in acreage from 1,994 in 1899 to 2,913 in 1909, when the production was 2,336,562 quarts, valued at \$191,002. The total acreage of potatoes and other vegetables in 1909 was 88,224, valued at \$6,968,618. Excluding potatoes, sweet potatoes and yams, other vegetables increased in acreage from 29,290 in 1899 to 43,524 in 1909, when the production was valued at \$4,519,891. Flowers and plants and nursery products decreased in acreage from 586 in 1899 to 189 in 1909, when the production was valued at \$157,615.

The total production of orchard-fruits in 1909 was 1,709,959 bushels, valued at \$3,010,192. Apples contributed about nine-tenths of this quantity, and peaches and nectarines most of the remainder. Apple trees of bearing age in 1910 numbered 4,570,948; those not of bearing age, 2,772,025. The production of apples in 1909 was 4,225,163 bushels, valued at \$2,461,074. Peach and nectarine trees of bearing age in 1910 numbered 1,424,582; those not of bearing age, 1,441,188.

The production of peaches in 1909 was 328,901 bushels, valued at \$368,584. Other orchard-fruits produced in 1909 were: 79,723 bushels of cherries, valued at \$111,043; 32,948 bushels of plums and prunes, valued at \$48,522; 29,916 bushels of pears, valued at \$32,101; and 13,163 bushels of quinces, valued at \$18,676.

The production of grapes in 1909 was 3,224,751 pounds, valued at \$92,834. Grape-vines of bearing age in 1910 numbered 284,074; those not of bearing age, 76,465.

The total production of nuts in 1909 was 974,312 pounds, valued at \$16,049. The more important of the nuts produced were: 878,215 pounds of black walnuts, valued at \$11,430; 17,337 pounds of Persian or English walnuts, valued at \$2,153; and 40,380 pounds of chestnuts, valued at \$1,830.

Of the small-fruits grown in West Virginia, strawberries are the most important, the acreage decreasing, however, from 799 in 1899 to 709 in 1909, when the production was 812,049 quarts, valued at \$74,778. Blackberries and dewberries increased in acreage from 367 in 1899 to 1,292 in 1909, when the production was 803,498 quarts, valued at \$48,854. Raspberries and loganberries increased in acreage from 704 in 1899 to 847 in 1909, when the production was 648,174 quarts, valued at \$60,749. Other small-fruits produced in 1909 were 34,009 quarts of currants, valued at \$3,153, and 35,632 quarts of gooseberries, valued at \$3,238.

The acreage devoted to the production of potatoes, the most important of the vegetables, increased from 30,123 in 1899 to 42,621 in 1909, when the production was 4,077,066 bushels, valued at \$2,278,638. Sweet potatoes and yams decreased in acreage from 3,393 in 1899 to 2,079 in 1909, when the production was 215,582 bushels, valued at \$170,086. The production of the more important of the other vegetables in 1909 was: 1,846 acres of tomatoes, valued at \$87,386; 3,464 acres of green beans, valued at \$60,156; 878 acres of sweet corn, valued at \$37,449; 212 acres of cabbage, valued at \$24,562; 473 acres of watermelons, valued at \$21,059; 163 acres of turnips, valued at \$4,809; 35 acres of onions, valued at \$4,442; and 72 acres of green peas, valued at \$2,053. Vegetables of less importance were asparagus, cantaloupes, celery, cucumbers, lettuce, and radishes.

The acreage devoted to the production of flowers and plants decreased from 39 in 1899 to 25 in 1909. The total area under glass in 1909 was 296,717 square feet, of which 272,182 were covered by greenhouses, and 24,535 by sashes and frames. The value of the flowers and plants produced in 1909 was \$78,377, as compared with \$44,384 in 1899.

Nursery products decreased in acreage from 547 in 1899 to 464 in 1909, when their value was \$79,268, as compared with \$61,700, in 1899. W. H. ALDERMAN.

North Carolina.

North Carolina (Fig. 2512) is a long, narrow strip of land in eastern United States, occupying a medial position between North and South. It extends 503 miles from east to west, with an average width of about 100 miles. Since the state extends from the surf of the ocean to the highest altitudes east of the Rocky Mountains, it has a very complex topography, a varying climate, a multiplicity of soil types and a consequent wide range of vegetable products.

North Carolina is divided into three parts, the Mountain region, the Piedmont and the Coastal Plain. The Coastal Plain begins at the Atlantic Ocean and extends inland a distance of about 150 miles. The land is extremely level, in most places not varying in elevation over a foot to the mile. Along the sounds and in the tide-water section there is from 4,000 to 5,000 square miles of swamp. A part of this area has been drained and is found to be extremely rich agricultural land.

About 100 square miles of the great Dismal Swamp lies within this state. Cleared parts of this region have become the richest agricultural and trucking land in the state. On its western border the coastal plain merges into the lower Piedmont region at an altitude of 150 to 200 feet.

The Piedmont region is a rolling hilly country comprising nearly one half of the state. It is gently undulating on its eastern border where it merges into the coastal plain, but assumes a bolder and more rugged aspect as it nears the Blue Ridge Mountains. It is the general farming section of the state.

The western, or mountain section of North Carolina is the most rugged and picturesque mountain region east of the Rockies. In this limited area all the ranges of the Appalachian system seem to have united and fused and then broken up in a confusion of lofty peaks with a labyrinth of intervening valleys. Within a range of 50 to 100 miles there are forty-three mountain peaks, 6,000 feet and upward in altitude. Several rivers which empty into the Atlantic Ocean or into the Gulf of Mexico find their sources in this high region. In all this maze of mountains, the Great Smokies form a continuous range on the west and make a natural border between North Carolina and Tennessee. The Blue Ridge with its subsidiary ranges and outlying spurs forms the eastern border of this region where it drops abruptly about 1,500 feet to the Piedmont plateau. These two general ranges are connected by many spurs and cross-ranges. The general altitude of the mountain valleys and elevated plateaus varies from 2,000 to 3,000 feet.

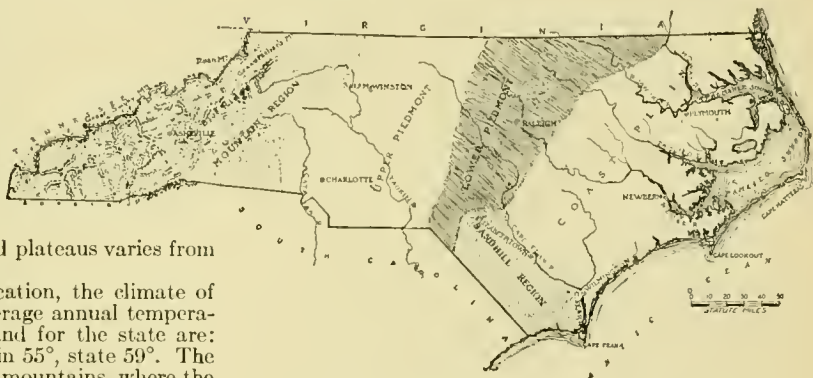
On account of its southern location, the climate of North Carolina is mild. The average annual temperatures for the different sections and for the state are: coast 61°, Piedmont 59°, mountain 55°, state 59°. The summers are warm, except in the mountains, where the altitude gives a cool climate like that of the northern states. Snow seldom falls and never lasts more than a few days. In the coastal section the winters are so mild that truck crops, such as spinach, kale, onions, cabbage, peas and lettuce are extensively grown in the open without protection during the winter season. The average annual precipitation for the state is 52 inches, for the coast 51, for the Piedmont 49, for the mountains 57. The rainfall is well distributed throughout the growing season, making irrigation unnecessary. The average length of the growing season as ascertained by the Weather Bureau records varies from 250 days near the coast to 200 in the central Piedmont and 180 to 190 in the mountains. In the coastal section, this long season permits the maturing of subtropical crops, such as cotton, peanuts and sweet potatoes, and gives the trucker a succession of two, three and even four crops a season.

The soils of the coastal region are of light sandy texture and are mostly underlaid with clay. They are classified by the Bureau of Soils as the Portsmouth, Norfolk and Orangeburg series. They vary from sand to sandy loam and fine sandy loam. These soils warm up quickly, are easy of cultivation and are therefore valuable for trucking purposes. In the swamp areas the soil is a rich black vegetable mold, varying from 2 to 6 feet in depth.

The Piedmont soils are of the Cecil clay series in which the clays predominate. Toward the east they are more or less blended with the sandy types of the coastal plain. The Piedmont clays are strong soils of friable texture and respond readily to cultivation. They are especially valuable for general farming and are capable of producing a wide variety of crops.

The mountain soils belong to the Porter and Toxaway series. The Toxaway soils which are of an alluvial nature are found in the valleys and bottom lands, while the Porter types are characteristic of the mountain slopes. In high mountain coves is found the Porter black loam, a soil much renowned for the production of fruit of the very finest quality.

On account of the wide range in altitude, the numerous soil types and the varied climatic conditions, the native flora of North Carolina is extremely rich and varied. Botanists from all over the world have studied the flora of this region, because within a few miles can be found the flora of the north overlapping with the subtropics, while the dense jungle of swamp and coastal vegetation lies within a day's travel of the alpine species of the mountains. In the southeast are found the palmetto, live-oak and cypress festooned with Spanish moss and intertwined with smilax and jessamine; a little farther up brings the long-leaf and numerous other species of pines, the gums and various species of oaks and hickories, while in the mountains are found huge timber trees of northern white pine, spruce, balsam and hemlock and dense thickets of



2512. North Carolina, showing the main divisions.

laurel and rhododendron. A survey of the native fruit-bearing plants of the state shows eighteen families including thirty-nine genera and upwards of 330 species. The non-fruit-bearing plants and general flora run into great numbers of species.

The nurseries of the mountain region make a specialty of native ornamentals and alpine plants which are shipped in large quantities to all parts of the country. This region is one of the chief sources of supply for medicinal herbs which are gathered by the mountain people and shipped out in immense quantities by wholesale dealers of crude drugs. Cultivated ginseng is a considerable article of commerce. The great bulk of peach seed used by nurserymen all over the country is produced in this region.

The greatest horticultural industry in North Carolina is truck-growing. Its mild southern climate, light friable soils and accessibility to large markets makes eastern North Carolina an ideal section for trucking, especially during the winter and early spring months. In the market, North Carolina truck comes intermediate between Charleston and Norfolk. Early Irish potatoes make the largest tonnage, going north in early spring by boat and trainloads. The crop comes off the land sufficiently early to give place to corn, cotton and other farm crops. In the mountains the late varieties of potatoes are grown in considerable quantities, and marketed during the fall and winter. Early cabbages of the Wakefield type are extensively grown in the east in the winter and early spring and, like potatoes, are followed by a variety of truck or farm crops. The late, heavy types of cabbage are grown in summer in large

quantities in the rich valley lands of the mountains. The sweet potato is grown in greater or less acreage on almost every farm in the state. The total of this production is a very large item amounting to about 8,000,000 bushels, one-seventh of the total crop of the United States.

Watermelons and cantaloupes are extensive truck crops in the sand-hill section of the state. The plantings of some of the larger growers run into hundreds of acres. In the shipping season, trainloads of refrigerator cars of melons and cantaloupes go north daily.

The growing of the head types of lettuce has become a considerable industry in North Carolina. The early crop is grown under cotton covers and the later ones in the open field. The lettuce crop is usually followed on the same land by radish, cucumbers or beets. Snap beans and English peas are much used as early spring catch-crops before the general summer farm crops. A considerable industry has developed in some localities in the production of very early corn for northern markets, before the northern crop comes in.

The strawberry is so extensively grown in North Carolina as to be considered a regular field crop. At Chadbourn, Mt. Tabor and other points along the Coast Line Railroad, the production of strawberries is so great that the large northern markets have found it to their advantage to send their agents to buy on the track as the cars are loaded. During the season, solid trainloads of ice cars of berries leave the strawberry section of North Carolina daily. The dewberry is also rapidly becoming a commercial fruit crop of importance, the output ranging in the neighborhood of 300 cars a season.

In the last decade, North Carolina has made rapid development in the commercial culture of apples. The high altitude combined with rich mountain soils and bright but cool climate make fruit of high color and a fine quality. Standard northern varieties are grown as well as many of southern origin. On many mountain slopes, owing to favorable air-drainage, thermal belts or zones are found where orchards have a high immunity to injury by cold. For this reason the commercial orchards are located mostly on the high sloping sides of the mountains. Commercial orchards vary in size from a few hundred up to as high as 50,000 trees. (See Volume I, page 322.)

The peach orchards of North Carolina are situated mostly in the sand-hill section, but there is a general exodus of peach-growing to the higher lands of the foothills and mountain spurs where thermal conditions give a greater exemption from frost. North Carolina peaches are of high color and excellent quality. They go to market about ten days later than the Georgia crop and nearly two weeks earlier than the northern peaches.

The grape in North Carolina is represented by two different types,—the muscadines, which are native of the coastal region, and the labruscas or "bunch grapes," which are grown mostly in the Piedmont and mountains. The Scuppernong, a white variety of the muscadine or rotundifolia type, is found as a domestic fruit on almost every plantation in eastern Carolina. Like the fig, it has proved to be almost an ideal home fruit for the South. It will stand almost any kind of neglect and almost unfailingly produces an abundant crop of very excellent fruit.

Some very large vineyards of Scuppernong grapes have been developed for wine purposes, but in the face of an increasing temperance sentiment the industry is not enlarging. At the horticultural branch experiment station, at Willard, an extensive experiment with muscadine grapes is being conducted by the State Department of Agriculture and Experiment Station in cooperation with the Division of Pomology of the National Department of Agriculture. The most promising varieties of the rotundifolia species from Virginia to Texas have

been collected and are being tested. Breeding work is under way to develop varieties of this species that will be valuable for dessert and market purposes. When given careful tillage and an especially thorough spraying, the "bunch grapes" produce very fine fruit.

The "paper-shell" pecan is rapidly coming into prominence in eastern North Carolina as an orchard crop. Orchards of budded pecan trees of standard varieties are being planted every year and the earlier plantings are coming into bearing. Seedling groves are being top-worked to named varieties. In the Piedmont section, plantings are being made of English walnuts.

Public-service agencies for horticulture.

The Land-Grant college of North Carolina commonly known as the "College of Agriculture and Mechanic Arts," is located at West Raleigh. The institution was established in 1889. The teaching work in horticulture is carried on by one professor and one instructor.

The North Carolina Agricultural Experiment Station was established originally as a division of the State Department of Agriculture, in 1877. In 1887 the Station became a department of the College and was conducted jointly by the College and the Department of Agriculture from 1887 to 1907 with the exception of three years. The branch experiment stations, or test farms, are located so as to represent the major soil types, the climatic conditions and the principal agricultural and horticultural industries of the state. The Pender station is located at Willard, 33 miles north of Wilmington. It represents the great trucking industry of the state. The Edgecombe station, situated near Rocky Mount, is located to represent the northeastern coastal section and the soils of that region. The experiments are principally with corn, cotton and peanuts. The Iredell station, located at Statesville, represents the Cecil clay soil type and the crops of the Piedmont region. The Swannanoa station is located in the mountains near Asheville at an altitude of 2,200 feet. It represents the principal soil types and crops of the mountain region. The Transylvania station is located so as to represent the best conditions for commercial apple-culture. It has a wide range in altitude and soil conditions. The Granville station, located at Oxford in the old bright tobacco belt, has been equipped for experimental work in the culture and curing of tobacco. The Black Land station is located at Wenona and represents the muck soils of the swamp areas, of which there are between 2,500,000 and 3,000,000 acres in the state. There are five members of the horticultural staff of the Experiment Station. Forty-four bulletins on horticultural subjects have been issued.

There are no special schools in the state devoted to horticulture, but horticulture is taught in connection with agriculture at the new agricultural high-schools. Horticulture is not taught in the public schools, except occasionally in the form of nature-study or school-gardens.

North Carolina has a well-equipped State Department of Agriculture, divided into twelve divisions. The Department issues a monthly series of bulletins of which thirty-three have been on horticultural subjects.

The work done by the State Horticulturist in addition to that in connection with the Experiment Station and test farms is largely in the nature of extension or development work. A cooperative investigation was begun in 1912 with the National Weather Bureau to study the phenomena known as "thermal belts" or "frostless zones," found so commonly in the mountains of North Carolina. Observing stations have been located at different altitudes and on varying slopes and exposures at seventeen places in the mountains.

The newly organized Division of Markets is forming cooperative associations for the better distribution and marketing of fruits, vegetables and other products.

The inspection of nurseries for San José scale and

other injurious pests is under the control of the Entomologist of the State Department of Agriculture.

Statistics (Thirteenth Census).

The land area of North Carolina in 1910 was approximately 31,193,600 acres. The land in farms was 71.9 per cent of the land area, or 22,439,129 acres. Of this land in farms, the improved land numbered 8,813,056 acres; the woodland 12,451,739 acres; and other unimproved land 1,174,334 acres. The total number of farms in the state in 1910 was 253,725, and the average acreage to the farm 88.4. [The total area is 52,426 square miles.]

The most important of the agricultural crops grown in North Carolina are cereals and cotton. The acreage of cereals decreased from 3,794,064 in 1899 to 3,250,870 in 1909, when the production was valued at \$37,848,797, which was 26.5 per cent of the total value of all crops. Cotton, including cotton-seed, increased in acreage from 1,007,020 in 1899 to 1,274,404 in 1909, when the value of the production was \$50,483,345. In the same year the production of tobacco from 221,890 acres was valued at \$13,847,559. The value of the forest products of the farms in 1909 was \$11,364,134, as compared with \$4,915,991 in 1899.

Horticultural crops grown in North Carolina are fruits and nuts, small-fruits, potatoes, sweet potatoes and other vegetables, and flower and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$3,635,425, as compared with \$1,470,735 in 1899. There was a decrease in the acreage of small-fruits from 6,837 in 1899 to 6,701 in 1909, when the production was 12,827,427 quarts, valued at \$853,076. The acreage of potatoes and other vegetables increased from 156,947 in 1899 to 212,710 in 1909, when the production was valued at \$12,585,018. Excluding potatoes, the acreage of other vegetables increased from 64,598 in 1899 to 95,980 in 1909, when the production was valued at \$6,496,308. The acreage of flowers and plants and nursery products decreased from 1,210 in 1899 to 861 in 1909, when the production was valued at \$393,963.

The total production of orchard-fruits in 1909 was 6,324,301 bushels, valued at \$3,248,036. Apples produced about three-fourths of this quantity and peaches most of the remainder. The apple trees of bearing age in 1910 numbered 4,910,171; those not of bearing age, 1,835,337, and the production in 1909 was 4,775,693 bushels, valued at \$2,014,670. Peach trees of bearing age in 1910 numbered 2,661,791; those not of bearing age 861,042, and the production in 1909 was 1,344,410 bushels, valued at \$1,041,767. Other orchard-fruits produced in 1909 were: 84,019 bushels of pears, valued at \$81,347; 61,406 bushels of plums and prunes, valued at \$45,274; 53,788 bushels of cherries, valued at \$60,453; 3,435 bushels of mulberries, valued at \$3,065; 1,125 bushels of quinces, valued at \$1,017; and 425 bushels of apricots, valued at \$443.

The production of grapes in 1909 was 15,116,920 pounds, valued at \$336,083. The grape-vines of bearing age in 1910 numbered 411,278; those not of bearing age, 120,208.

The production of nuts in 1909 was of comparatively little importance, there being only 1,244,629 pounds produced, valued at \$28,535. While the black walnut is the most important nut, there being 1,081,480 pounds of them produced in 1909, valued at \$16,138, as compared with 74,861 pounds of pecans, valued at \$8,194; it is interesting to note that the pecan trees of bearing age in 1910 numbered 6,876 while those not of bearing age numbered 20,781. In 1909 there were also produced in North Carolina 73,303 pounds of Persian or English walnuts, valued at \$3,686.

Tropical fruits are of little importance in North Carolina, the total value of those produced in 1909 being \$22,771, of which \$22,632 were contributed by 660,624 pounds of figs.

Strawberries are by far the most important of the small-fruits, with blackberries and dewberries ranking next. The acreage devoted to strawberries decreased from 5,616 in 1899 to 5,420 in 1909, when the production was 10,313,361 quarts, valued at \$712,126. The acreage of blackberries and dewberries increased from 1,073 in 1899 to 1,233 in 1909, when the production was 2,464,065 quarts, valued at \$136,609. Other small-fruits produced in 1909 were: 37,764 quarts of raspberries and loganberries, valued at \$3,388; 5,831 quarts of gooseberries, valued at \$536; 5,382 quarts of currants, valued at \$400; and a small amount of cranberries.

The acreage devoted to the growth of the sweet potato increased from 68,730 in 1899 to 84,740 in 1909, when the production was 8,493,283 bushels, valued at \$4,333,297. Potatoes increased in acreage from 23,619 in 1899 to 31,990 in 1909, when the production was 2,372,260 bushels, valued at \$1,755,413. Peanuts formed a considerable industry in 1909, the acreage having increased from 95,856 in 1899 to 195,134 in 1909 when the production was 5,980,919 bushels, valued at \$5,368,826. The production of the more important of the other vegetables was: 5,825 acres of watermelons, valued at \$179,238; 2,256 acres of cantaloupes and muskmelons, valued at \$163,902; 1,371 acres of cabbage, valued at \$132,715; 2,387 acres of green beans, valued at \$61,100; 835 acres of green peas, valued at \$31,032; and 359 acres of tomatoes, valued at \$22,562. Other vegetables produced were asparagus, beets, sweet corn, cucumbers, lettuce, onions, green peppers, and turnips.

The acreage devoted to the production of flowers and plants, increased from 61 in 1899 to 107 in 1909. The total area under glass in 1909 was 193,139 square feet, of which 176,853 were covered by greenhouses, and 16,286 by sashes and frames. The value of the flowers and plants produced in 1909 was \$126,995. The acreage devoted to nursery products, however, decreased from 1,149 in 1899 to 754 in 1909, when the value of the nursery products was \$266,968.

W. N. HUTT.

South Carolina.

South Carolina (Fig. 2513) ranks thirty-eighth in land area among the states and territories of continental United States. Rising from the sea-level to an altitude of 3,436 feet in the northwestern part of the state, and combining as it does different types of soil and conditions of climate, it possesses wonderful horticultural possibilities. The horticultural interests receiving greatest attention are trucking and fruit-growing, although the plant trade business and the production of cut-flowers is now coming into prominence. With its splendid water-power, numerous manufacturing centers have sprung up, and such communities offer good local markets for horticultural products.

Horticulturally, the state is divided into five regions, namely: the Coastal, Pine, Sand Hill, Piedmont and Mountain regions. The Coastal region, embracing in addition to the narrow strip along the coast a number of islands, has a remarkably mild climate which permits the growing of subtropical fruits, such as the fig and the more hardy citrus fruits. The fig, particularly, grows to perfection in this locality, and its production for preserving purposes is on the increase. Pecans and strawberries are also grown extensively here. The fine sandy loam soil, with the water-table only a few feet below the surface, furnishes ideal conditions for both these crops. There are individual growers that have hundreds of acres planted to pecans and about 1,000,000 quarts of strawberries are shipped annually from this region to northern markets. This region is especially adapted to commercial vegetable-growing. The products come in just after the Florida crops are off, which eliminates competition and gives the growers an open market. The principal vegetables grown are asparagus, beans, cabbage, cucumbers, lettuce, green

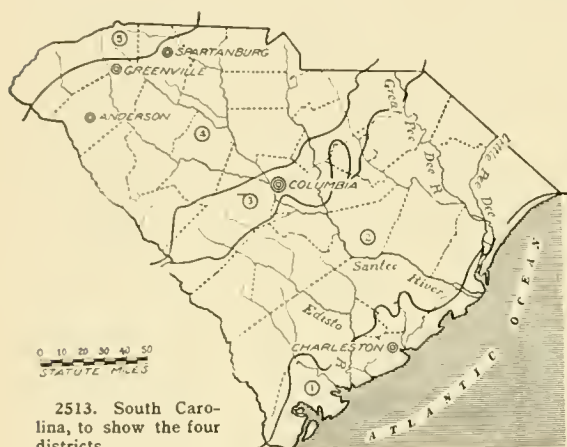
peas and potatoes. The islands along the coast are famous for the production of cabbage plants. Four million or more packages of cabbage plants are shipped out from here annually to all parts of the United States.

The Pine Belt is primarily a farming section with large plantings of cotton, corn, oats and other general farm crops. The region is mostly flat with an average slope of $3\frac{1}{2}$ feet to the mile in the southeastern part, where there are numerous fresh-water swamps, and a slope of about 5 feet to the mile in the northwestern part. It extends across the state parallel to the Coastal region, having a varying width from 50 to 80 miles. Although general farming interests are of chief importance in this region, there are a few horticultural crops that are proving remunerative. A considerable area is devoted to the growing of cantaloupes and watermelons, which are shipped to the northern markets. In some counties, asparagus is also grown as a commercial

product. eastern portion to 900 feet in the northwestern portion. There is magnificent water-power in the many streams which have been utilized in manufacturing interests, creating a large mill population and making a good field for the market-gardener. Probably the leading fruit of commercial importance in this section is the peach, which does well on the elevated areas. All the summer varieties of apples do well here and a few of the winter varieties, as the Winesap, Delicious, Yates, and Ben Davis, but there are few commercial plantings of importance. The canning industry has reached considerable proportions in this section, both fruit and vegetables being used in canning. The principal fruits that are canned are peaches, apples and blackberries, while the chief vegetables used are tomatoes, snap beans and corn.

The Mountain region occupies the northwestern corner of the state, including the greater part of Oconee, Pickens, Greenville and a small part of Spartanburg counties. The soil on the mountainsides is in most cases very fertile and the elevation is from 1,000 to nearly 3,500 feet, which makes this region particularly well adapted to the growing of those fruits that require a high altitude. Apples do especially well here, and almost all the leading commercial varieties are grown. They produce heavy crops, and in color, flavor, and keeping quality are not surpassed by the apples of any section in the eastern part of the United States. It has long been known that in this part of South Carolina excellent winter apples could be grown, but it is only during the past fifteen years that commercial apple-growing has come into prominence. There are now a large number of orchards containing from a few hundred to thousands of bearing trees. The varieties most largely planted are Stayman Winesap, Red Winesap, Rome Beauty, Virginia Beauty, Delicious, and Kinnard. The box is gradually replacing the barrel as a shipping package. A few years ago almost the entire bulk of the apple crop that was not sold on the local markets was marketed in barrels, but the growers being quick to observe the advantages of the small package have discarded the barrel and adopted the Standard apple-box. There are several box-making plants in the vicinity of the larger growers that have an output of more than a thousand boxes a day. In a few instances the growers own and operate their own box-making plants. The large amount of timber land in this region, with the splendid water-power, makes it possible to operate such plants at comparatively small cost. Aside from the commercial orchards now in bearing, there are a number of young orchards from one to five years old, and it will be only a short time before the face of these hitherto wooded hills will be covered by wealth-producing orchards. Other fruits that thrive in this region, but fail to do well in other sections of the state, are the sweet cherry, red raspberry, currant, and gooseberry. There are at present no commercial plants of importance of these fruits, although the home gardens produce them in abundance. Cabbages, onions, and potatoes are grown extensively in this region for the fall and winter trade. They are sold locally and to some extent shipped to the southern cities. The tomato is also grown extensively in some sections of the Mountain region for canning purposes. In a few instances large areas have been devoted to this crop for marketing in the Gulf States during the early fall. All vegetables and small-fruits may be grown successfully in this region.

It may be seen, therefore, that the horticultural products are extremely varied. From the seashore to the mountains, there are sections peculiarly adapted to particular horticultural interests; yet, taking the state as a whole, with the exception of the few subtropical fruits that do well in the Coastal region, all the principal fruits of the temperate zone may, if given proper care, be grown in every part of the state.



2513. South Carolina, to show the four districts.

product. Rotundifolia grapes, Japanese persimmons and figs grow luxuriantly in this region, but they have received little attention in a commercial way.

The Sand Hill region comprises an area of about 30 to 40 miles in width, stretching through the central part of the state from the Savannah River to the North Carolina line. Being for the most part a chain of hills with deep sandy soil, this region is remarkably well adapted to the growing of peaches, Labrusca grapes and dewberries. All of these fruits attain high quality and color here and ripen early. The Mayflower variety of peaches is ready for market by the last of May. The Delaware is the most largely grown of all the varieties of grapes because of its good shipping quality and splendid flavor, but the Brighton, Niagara, and Concord varieties are grown considerably for the local markets. Dewberries, ripening the earliest of all the berries, bring good prices on the local as well as more distant markets. The largest peach-growers of the state are in this region, individual growers in some cases having as many as 20,000 to 30,000 trees. A great many young orchards, varying in size from 100 to 5,000 trees, have recently been set. There are no commercial plum orchards in this region, although varieties of the Japanese and Wild Goose types of plums do well. This region is also well adapted to the growing of early vegetables, and market-gardening is being carried on rather extensively in areas adjacent to the larger towns.

The Piedmont region includes all of the northwestern portion of the state except parts of the counties of Oconee, Pickens, Greenville and Spartanburg, which lie in the extremely northwestern corner of the state and make up the mountain region. The elevation of the Piedmont region varies from 400 feet in the south-

For instance, in the home orchards throughout the state may be found almost every manner of fruit. Also are found numerous fruits, such as the blackberry, dewberry, huckleberry, chickasaw and wild goose plums and the sour cherry growing luxuriantly in the wild state.

Among the former prominent horticulturists in South Carolina may be mentioned Meggot, a Huguenot, who is recorded as having obtained a grant of money from the legislature of South Carolina about the year 1800 for the development of the grape industry; Nicholas Herbemont, of Columbia, the originator of the Herbemont grape; J. F. C. DuPre, the first Professor of Horticulture of Clemson Agricultural College and the first Horticulturist of the South Carolina Experiment Station; James Stanley Newman, the first Professor of Agriculture of Clemson Agricultural College and also at one time prominent in horticultural affairs in Georgia and Alabama (see Volume III, page 1589).

Public-service agencies for horticulture.

In South Carolina the principal source of agricultural information is the Clemson Agricultural College, at Clemson College. This is the state's agricultural and mechanical institution. It was incorporated in 1889, but did not open until 1893. There are five on the horticultural staff at this time.

The South Carolina Experiment Station is a department of Clemson College. It is located at the college and there are two substations, one at Summerville, in the Coastal region, and one at Florence, in the Pee Dee region. The establishment of another substation in the Sand Hill region is contemplated. The station workers in horticulture are three in number. Fourteen bulletins on subjects related to horticulture have been published.

Some elementary instruction in horticulture is given at the Winthrop Normal and Industrial College (female), Rock Hill, and at the Colored Normal and Industrial Agricultural and Mechanical College, at Orangeburg. Among the public schools of the state there are about a hundred which are teaching agriculture under the direction of the extension division of Clemson College. In these schools horticultural instruction is given, and a considerable number of them have 1-acre orchard demonstration plots. The teaching of agriculture in the public schools of the state is spreading rapidly.

The extension division of Clemson College has two horticulturists working over the state throughout the year. The work has concerned itself largely with building up commercial orcharding in the state. The peach and the bunch grape are the fruits most generally grown on a commercial scale. Attention has been given to the question of marketing the fruit. Much has been done to encourage home orchards and in most of the counties there have been established model 1-acre demonstration orchards. There have been campaigns for the establishment of home gardens, especially fall and winter gardens. Canneries have been encouraged and the state is well up in the canning club work for girls. The extension division at Clemson College also employs an agent in marketing, who devotes part of his time to bettering market conditions for horticultural products.

A rigid inspection service is maintained by the State Crop Pest Commission, whose executive officers are the plant pathologist and entomologist of Clemson College. They inspect nursery stock and importations of nursery stock, and in other ways prevent the spread of noxious insects and diseases.

Statistics (Thirteenth Census).

The approximate land area of South Carolina was reported in 1910 as 19,516,800 acres. The land in farms as 69.2 per cent of the land area, or 13,512,028 acres.

Of this land in farms, the improved land numbered 6,097,999 acres; the woodland, 6,339,142 acres; and the other unimproved land in farms, 1,074,887 acres. The number of all the farms of the state in 1910 was 176,434, and the average acreage to the farm was 76.6. [The total area is 30,989 square miles.]

The leading agricultural crops of the state are cotton, including cotton seed, and cereals. The acreage devoted to the production of cotton increased from 2,074,081 in 1899 to 2,556,467 in 1909, when the production was valued at \$96,381,067, which was 67.9 per cent of the total value of all crops. The cereals decreased in acreage from 2,251,050 in 1899 to 1,955,695 in 1909, when the production was valued at \$25,434,539. Hay and forage increased in acreage from 106,124 in 1899 to 209,767 in 1909, when the production was valued at \$3,189,122. Tobacco increased in acreage from 25,993 in 1899 to 30,082 in 1909, when the production was valued at \$2,123,576. The value of the forest products of the farms in 1909 was \$4,153,092, as compared with \$1,915,280 in 1899.

Horticultural crops produced are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts in 1909 was \$1,121,662, as compared with \$360,515 in 1899. Small-fruits increased in acreage from 591 in 1899 to 856 in 1909, when the production was 1,408,099 quarts, valued at \$113,254. In 1909 the total acreage of potatoes and other vegetables was 109,482 and their value \$6,922,021. Excluding potatoes, the acreage of the other vegetables increased from 40,771 in 1899 to 51,994 in 1909, when the production was valued at \$3,705,991. Flowers and plants and nursery products decreased in acreage from 112 in 1899 to 44 in 1909, when the production was valued at \$56,503.

The total production of orchard-fruits in 1909 was 1,132,668 bushels, valued at \$956,376. Peaches and nectarines contributed more than half this quantity, and apples most of the remainder. The production of peaches and nectarines was 643,040 bushels, valued at \$557,303. The number of trees of bearing age in 1910 was 1,336,142 and those not of bearing age, 349,790. Apple trees of bearing age in 1910 numbered 581,767; those not of bearing age, 269,044. The production in 1909 was 362,800 bushels, valued at \$276,410. The production of the other orchard-fruits was as follows: 65,680 bushels or pears, valued at \$67,685; 48,754 bushels of plums and prunes, valued at \$37,555; 10,987 bushels of cherries, valued at \$15,880; 504 bushels of apricots, valued at \$620; 534 bushels of quinces, valued at \$587; and 369 bushels of mulberries, valued at \$336.

The production of grapes in 1909 was 2,016,506 pounds, valued at \$88,620. Grape-vines of bearing age in 1910 numbered 79,708; those not of bearing age, 19,704.

Nuts were produced in 1909 to the amount of 376,013 pounds, valued at \$26,888. The production of the various nuts was 159,823 pounds of pecans, valued at \$20,442; 185,252 pounds of black walnuts, valued at \$3,672; and 28,160 pounds of Persian or English walnuts, valued at \$2,583. Of the tropical fruits, 975,136 pounds of figs were produced, valued at \$49,169.

Of the small-fruits, the strawberries are the most important of those grown in South Carolina. Strawberries increased in acreage from 499 in 1899 to 815 in 1909, when the production was 1,337,208 quarts, valued at \$108,938. Blackberries and dewberries decreased in acreage from 39 in 1899 to 38 in 1909, when the production was 64,754 quarts, valued at \$3,710. Other small-fruits produced were 4,955 quarts of raspberries and loganberries, valued at \$477; 999 quarts of currants, valued at \$102; and 183 quarts of gooseberries, valued at \$27.

Concerning the potatoes and other vegetables in

South Carolina, the sweet potato increased in acreage from 48,831 in 1899 to 18,878 in 1909, when the production was 4,319,926 bushels, valued at \$2,606,606. Potatoes increased from 8,068 in 1899 to 8,610 in 1909, when the production was 782,430 bushels, valued at \$609,424. Of the other vegetables the more important were: 1,828 acres of cabbage, valued at \$270,675; 5,051 acres of watermelon, valued at \$146,418; 1,773 acres of asparagus, valued at \$138,317; 962 acres of cucumbers, valued at \$115,247; 1,732 acres of beans, valued at \$109,865; 977 acres of cantaloupes and muskmelons, valued at \$58,490; 49 acres of lettuce, valued at \$26,499; and 146 acres of tomatoes, valued at \$12,633. Vegetables of lesser importance were beets, carrots, sweet corn, onions, green peppers, radishes, and squash.

The acreage devoted to the production of flowers and plants in South Carolina decreased from 28 in 1899 to 23 in 1909. The total area under glass in 1909 was 74,318 square feet, of which 66,242 were covered by greenhouses and 8,076 by sashes and frames. The value of the flowers and plants produced in 1909 was \$52,094, as compared with \$7,920 in 1899.

The acreage devoted to nursery products decreased from 84 in 1899 to 21 in 1909, when the value of the nursery products was \$4,409, as compared with \$4,416, their value in 1899.

C. C. NEWMAN.

Georgia.

Georgia (Fig. 2514), one of the original thirteen colonies, is located in the southeastern part of the United States just north of Florida. It is the largest state east of the Mississippi. It extends from 30° 31' 39" N. on the south to 35° on the north, and its greatest breadth is found between 81° W. on the east and 85° 53' 38" on the west. From Savannah to Brunswick the boundary is the Atlantic Ocean, and from the coastal islands to some 30 or 40 miles inland the territory is practically at sea-level, the soil being alluvial and sandy; the climate here is subtropical, and such plants as the palmettos, figs, olives, and citrus flourish.

From the coast section along the Florida border, west to the Alabama line and as far north as Columbus, Macon and Augusta, through which cities the fall line passes, is found the great Atlantic Coastal plain. This section of the state is known as South Georgia; it has an elevation from the sea-level to 500 feet, the average being around 250 feet. The soil is mostly sandy, underlain with clay, with an occasional outcropping of the underlying clay. This is a great cotton, melon and peach section. North of the fall line to Cartersville and Gainesville is found the Piedmont plateau. The country is very hilly and broken, the elevation being from 500 to 1,000 feet. The soil is mostly red clay, producing cotton, peaches and grapes. From Cartersville east and to the northern border of the state is located the mountain section. This region is rugged and broken, starting with an elevation of 1,000 feet on its southern border and reaching 5,000 feet in the north-central part. Here the apple attains perfection, and peaches do extremely well. The native forests contain such trees as the hemlock, white pine, and tulip tree. From Cartersville north and west is found the Appalachian Valley region. This is comparatively small in extent, is hilly and rugged, the elevation being from 500 to 1,200 feet. In all other parts of the state the geological features are comparatively simple, but here they are mixed and intricate. The apple and peach succeed well in this section. The extreme northwestern corner of the state dips into the Cumberland plateau, which section, however, is so small as to be practically negligible in a study of Georgia.

From the rice- and palmetto-covered islands of the coast, through the vast cotton fields, peach orchards and long-leaf pine forests, to the rhododendrons and

white pines that cover the mountains in the northern parts, one passes through eight of the nine climatic belts represented in the United States. The mean temperature of the mountains runs from 40° to 60°; that of the Piedmont plateau from 60° to 65°; and that of the Coastal plain from 60° to 70°. Zero temperatures have been reported from nearly all parts of the state, but from the southern parts such reports are exceedingly rare. The maximum summer temperatures will run from 95° to 102°, the latter, however, being the great exception. The rainfall reaches a maximum of 71.7 in the northeastern corner of the mountain section and a minimum of 39.4 inches in Swainsboro, a little south-east of the center of the state; the average is 49.3 inches. This variety of climates, coupled with a great diversity of soils, proves the horticultural possibilities of Georgia to be little less than marvelous.

The Horticultural Society has divided the state into four sections, following to some extent the geological divisions:

1. The Mountain region takes in all the mountain section, the Appalachian Valley, the Cumberland Plateau, and a small strip of the Piedmont Plateau. This



2514. Georgia, with the fruit and melon districts.

region is particularly adapted to the apple and late peach; quinces, cherries, currants, gooseberries, and other fruits of like climatic requirements also do well here, though they are not as yet of commercial importance. Cauliflower, celery and many other vegetables can be raised in this section, and a trade is growing up in late tomatoes and beans. The leading horticultural interests of the mountains at the present time are apples and peaches.

2. The Middle region, the largest division of the state, takes in most of the Piedmont Plateau and the northern half of the Coastal Plain. It is in the south-central section of this division that the mammoth peach orchards of the state are located. The Japanese plum, as well as other types, used to be extensively grown in this section, but the trees proved to be so susceptible to "plum wilt" and various other diseases and insects that the industry has fallen to a low ebb. Grapes of the *Labrusca* and *rotundifolia* types do exceptionally well in central Georgia; apples do fairly well in the northern part of this division, and melons prosper in the southern part. Figs, pecans, and most vegetables,

especially the sweet potato, thrive throughout this whole section; there is, however, little trucking, except for local markets.

3. The Southern region takes in the lower half of the Coastal Plain, and extends across the whole state from the Okefeenokee Swamp, west. This region is especially noted for its melons, pecans, and Kieffer pears. Some trucking for early market is done and the industry is growing. Figs grow exceptionally well in this section, and there are numerous citrus trees in the southern tier of counties that have produced fruits for some years past without protection.

4. The Coast region takes in the tier of counties along the coast, and extends from South Carolina to Florida; it is the smallest section of the state. Figs are here found at their best, and various citrus fruits grow well on the islands; at one time the indigo and olive were cultivated on these same islands, but now their culture has been abandoned. Trucking is followed in this region for the northern market, strawberries, onions, cabbage, potatoes, tomatoes, and peas being the main crops.

Georgia is the mother state of the Elberta peach, the Belle, Waddell, and several others of commercial importance. Fifty-five apples have originated within its borders, the most prominent of which are the Yates, Terry, Shockley and Nick-a-jack. The LeConte is its addition to the list of pears; it has added the Georgia Giant, the Atlanta, the Senator and others to the pecans, and its best-known melon is the Georgia Rattlesnake.

At the present time the greatest horticultural industry in the state is the peach business, and second to that come the melons. The apple industry is rapidly coming to the fore, and in several sections specialized trucking interests are growing up. Georgia is well infested with diseases and insects, and consequently, the growers find that constant spraying is essential to success. For several years orchards have been sadly neglected, mainly because they were larger than could be well taken care of, but that time is now past, and improved methods are rapidly taking their proper places.

There has been a slight decrease in the number of peach trees during the last decade; those removed, however, were old or neglected trees, which materially reduced the yield to a tree. The peach crop of 1908 was the largest in the history of the state, being about 7,000 carloads. In 1909 the crop was 904 carloads, and in 1910 the state shipped 6,289 carloads. The apple industry is rapidly increasing, thousands of trees being planted every year. The pecan interests are also enlarging; although the Census shows only 75,519 bearing trees, there are, young and old, 400,000 or more now growing in the state.

Small-fruits are not of so much importance, strawberries being the most widely grown.

The trucking interests are on the increase, proportionally as the pine forests of the southern part of the state are cleared up and settlers take charge of the warm sandy lands.

One of the promising new vegetable industries is the raising of asparagus, which is being carried on around Fort Valley and Marshallville. The raising of early truck in the southern parts of the state is now a well-established business, and a late truck industry is growing up in the mountain sections of the north. This latter interest is going hand in hand with the apple business.

The nursery interests of the state are fairly large, but only some three or four concerns have attained any great prominence.

Probably the two best-known horticultural products are the Georgia peach and the Georgia watermelon. The introduction of the refrigerator car made the conversion of cotton fields into peach orchards a possibility.

Cheap lands and cheap labor combined with a favorable climate helped in the planting of the enormous orchards that the state is noted for. The industry has now undergone the extensive stage and is rapidly becoming intensive. The melon business seemed to be natural to the soil and climate; it has attained vast proportions and is becoming more remunerative through the use of better methods.

Pecan-growing is now one of the most important new industries of the state; there are several instances on record where bearing orchards have been sold for as much as \$1,000 an acre. The apple orchards in the northern part of the state are vying with the pecans in public interest; lands in the mountains that could be purchased for \$1 to \$5 an acre twenty years ago are now being sold for \$25 to \$100 an acre for apple purposes. Numerous large orchards have been planted, but most of the plantings are small and are being brought into bearing along the most improved lines.

Horticultural collections and parks are scarce, those worthy of note being the Nurseries and Evergreen Collection of the Fruitland Nursery Company, near Augusta. The Ferrell Gardens, at LaGrange, are of particular interest, as they are the only remaining specimen of the old colonial landscape architecture. The Payne and Wade estates, near Thomasville, are magnificent examples of present-day landscape gardening, the former being noted for its collection of azaleas.

Georgia has been fortunate in having a great many individuals who have bent their efforts toward advancing horticulture long before this matter was taken up and given serious consideration by the authorities and the powers of the state. Some of these men are: Jarvis Van Buren, a native of Clarksville, who was especially interested in the dissemination of the apple in that section; James Camak, a native of Athens, who, with Van Buren, revised and published the second edition of "Gardening for the South," which was written by Wm. N. White, a sketch of whose life may be found in Volume III, p. 1602. P. J. Berckmans probably stands out as one of the greatest advancers of southern horticulture. He was a man of international reputation. A fuller discussion of his life may be found in Volume III, p. 1565. Jas. B. Hunnicutt, the author of "Agriculture for the Common Schools," and for a long time editor of the "Southern Cultivator," is also a man whose life work was mainly given for the advancement of Georgia's agriculture, but his paper always carried a horticultural section in which he was particularly interested.

Public-service agencies for horticulture.

The Land-Grant College of Georgia was opened in 1872 as a subdivision of the University of Georgia in Athens. In 1906 the Conner bill was passed by the Legislature of Georgia reorganizing this institution. The reorganization took place in 1907. At the time of the reorganization the department of horticulture in the old College of Agriculture had one instructor in charge with very meager equipment. At the present time the department consists of three faculty members. The department of horticulture is also represented in the graduate school of the University of Georgia.

The Georgia Experiment Station was originally located in Athens in 1888; in 1889 it was removed from under the Board of the University of Georgia and placed under a special Board appointed by the Governor and located at Experiment, two miles from the city of Griffin. At present the Station has one horticulturist, and there are twenty acres devoted to orchard and truck plats, there being approximately 325 varieties of fruits and the like represented. The strictly horticultural publications of the Station are thirty-two to the present date.

In the educational system of Georgia there are Congressional District Agricultural Schools. At the present time eleven districts have these institutions in operation. They are really secondary agricultural schools and horticulture is taught. The North Georgia Agricultural College, subdivision of the University of Georgia, located at Dahlonega, also offers instruction in horticulture. The general agriculture required in the grammar schools has some horticultural instruction, but this is mostly elementary and curtailed in its extent. There are no private schools offering courses along this line within the state and none offering work for a degree except the Georgia State College of Agriculture, of the University.

The extension work in horticulture is carried on directly through the department of horticulture of the Georgia State College of Agriculture. The special extension work along horticultural lines at the present time consists in the running of coöperative experiments in various sections of the state on the different horticultural crops; the organization of small truck and fruit coöperative associations; the assisting of the various demonstration agents, many of whom are located in sections directly interested in horticulture. The department is also making efforts to facilitate and help in the landscaping of the school buildings of the small towns and rural districts. The time of one man is devoted absolutely to the extension work and when necessary other members of the department assist in the extension movement.

There is no state board of horticulture in Georgia. In 1897 an act was passed by the Legislature establishing the State Board of Horticulture and Pomology, but in 1898 this act was amended, changing this Board into the State Board of Entomology. This Board instituted a State Department of Entomology and appointed a State Entomologist.

The regulations of the State Board of Entomology require that nurseries be inspected annually for the various diseases and pests that are on their prescribed list. It also requires that every plant of any kind that is shipped into or from the state of Georgia must have an inspection tag of the Board of Entomology attached thereto.

In 1876 P. J. Berckmans founded the Georgia State Horticultural Society, at Macon. This organization has persisted until the present time.

Statistics (Thirteenth Census).

The approximate land area of Georgia, according to the census of 1910, is 37,584,000 acres, of which 71.7 per cent, or 26,953,413 acres are in farms. Of this farm land, 45.6 per cent, or 12,298,017 acres are improved; 13,002,741 acres are in woodland; and 1,652,635 acres are classified as other unimproved land in farms. The number of all the farms in 1910 was 291,027. The average acreage to the farm was 92.6. [The total area is 59,265 square miles.]

The leading agricultural crops are cotton, cereals, forest products of farms, sugar crops and hay and forage. In 1909 the value of the cotton crop, including cotton seed, was \$149,937,058, or 66.2 per cent of the total value of all the crops. The cotton crop in 1909 occupied 39.7 per cent of the improved land area, or 4,883,304 acres, as compared with 3,513,839 acres in 1899. The cereals occupied 3,906,703 acres in 1909 or 31.8 per cent of the improved land area, and the production of cereals was valued at \$42,405,019, which was 18.7 per cent of the total value of all crops. The value of the forest products of the farms was \$8,938,390 in 1909 as compared with \$3,217,119, their value in 1899. The acreage of sugar crops in 1909 was 52,707; in 1899 it was 37,609 and the value of the sugar crops in 1909 was \$2,689,056, as compared with \$1,731,296, their value in 1899. Hay and forage increased in acreage from 137,312 in 1899 to 253,157 in 1909, an increase of 84.4

per cent. The value of the hay and forage produced in 1909 was \$4,056,907, thus making hay and forage above the sugar crops in point of value.

Horticultural crops grown in Georgia are fruits and nuts, vegetables, including potatoes and sweet potatoes and yams, peanuts, small-fruits, and flowers and plants and nursery products. The value of the fruits and nuts in 1909 was \$3,143,114, as compared with \$673,189, their value in 1899, showing an increase of 366.9 per cent in value. In 1909 the total acreage of vegetables was 187,328 and their value \$10,614,601. The production of peanuts was 2,569,787 bushels, from a reported acreage of 160,317, and their value was \$2,440,926. Small-fruits decreased in acreage from 1,634 in 1899 to 988 in 1909, and the value of their products in 1909 was \$111,754. The growing of flowers and plants and nursery products is of some importance in Georgia. The acreage increased from 1,034 in 1899 to 1,646 in 1909, an increase of 59.2 per cent. The value of the flower and plant and nursery products in 1909 was \$637,860.

The production of orchard-fruits in 1909 was 256.8 per cent greater than in 1899, the total quantity produced in 1909 being 3,670,830 bushels, valued at \$2,930,793. Peaches and nectarines contributed about two-thirds of this quantity and apples and pears most of the remainder. The production of peaches and nectarines in 1909 was 2,555,499 bushels, as compared with 259,728 bushels, the production in 1899, and their value in 1909 was \$2,182,613. The production of apples in 1909 was 895,613 bushels, valued at \$555,744; that of pears 149,667 bushels, valued at \$134,604. The production and value of the other orchard-fruits in 1909 follow: plums and prunes, 60,845 bushels, valued at \$46,366; cherries, 4,979 bushels, valued at \$7,199; quinces, 2,021 bushels, valued at \$2,272; mulberries, 1,766 bushels, valued at \$1,449; and 440 bushels of apricots, valued at \$546.

In 1910, the number of grape-vines of bearing age in Georgia was 277,658; those not of bearing age 38,233. The production of grapes in 1909 was 2,767,366 pounds, valued at \$99,216; the production in 1899 was 8,330,485 pounds.

The value of all nuts produced in 1909 was \$61,106. The production was 845,553 pounds. The leading nuts grown, their production and value for 1909 follow: pecans, 354,046 pounds, valued at \$47,845; black walnuts, 427,607 pounds, valued at \$8,598; and 56,585 pounds of Persian or English walnuts, valued at \$4,161. Other nuts growing in Georgia are hickory-nuts, hazel-nuts, Brazil-nuts, Japan-nuts, chestnuts, beech-nuts, almonds and others.

The tropical fruits produced in Georgia in 1909 were valued at \$51,999. The most important of these, their production, and value were figs, producing 1,183,494 pounds, valued at \$50,326, and pomegranates, producing 27,365 pounds, valued at \$920.

Strawberries are by far the most important of the small-fruits raised in Georgia. In 1909 the production, from 890 acres reported, was 1,157,472 quarts, valued at \$101,161. The production of blackberries and dewberries was 67,285 quarts, valued at \$5,594; that of raspberries and loganberries, 33,928 quarts valued at \$4,663. Other small-fruits of minor importance are currants and gooseberries.

Of the vegetables in 1909 the sweet potatoes and yams were by far the most important. The production of sweet potatoes and yams from a reported acreage of 84,038 was 7,426,131 bushels, valued at \$4,349,806. The production of potatoes from a reported acreage of 11,877 was 886,430 bushels, valued at \$684,427. The area of other important vegetables grown in 1909 and the value of their products follow: watermelons, 16,298 acres, valued at \$410,147; cantaloupes and muskmelons, 3,022 acres valued at \$209,161; green beans, 1,484 acres, valued at \$102,488; tomatoes, 756 acres,

valued at \$57,270; cabbage, 806 acres, valued at \$57,191; and turnips, 445 acres, valued at \$29,470. Vegetables of less importance grown were asparagus, beets, sweet corn, cucumbers, lettuce, onions, green peas, green peppers, and squash.

The acreage occupied by the flower and plant industry in Georgia in 1909 was 144 acres and the value of the products \$271,427. The area of land under glass was 867,222 square feet, of which 741,672 square feet were covered by greenhouses and 125,550 square feet by sashes and frames.

The area on which nursery products were grown in 1909 was 1,502 acres, an increase of 56.9 per cent since 1899, when the area was 957 acres. The value of the nursery products in 1909 was \$366,433, as compared with \$172,143, the value of the nursery products in 1899.

T. H. McHATTON.

Florida.

The history of horticulture in Florida (Fig. 2515) dates from the earliest settlements, and even prior to that period the aborigines carried on a desultory plant-growing. The peculiarity of the soil, however, prohibited the extension of this work except in a few isolated places. It was necessary to introduce commercial fertilizers before horticulture could make rapid progress in this state. Up to the time of commercial fertilizers, it was thought that the hammocks were the only places capable of raising fruit, the remainder of the arable land being so sandy and wanting in plant-food that remunerative crops could not be grown on it excepting after it had been "cow-penned."

Such a soil, containing often over 90 per cent sand and insoluble matter, at first sight would seem to be absolutely worthless for horticultural purposes, but with the advent of the new horticulture it becomes the ideal soil. It is a lodgment for plants in which occurs no material that will prove deleterious to the crop, and all that is necessary is to add to it the material that will cause the plant to grow to the necessary size and produce fruit of the desired quality. Beautiful thin-skinned oranges grow only on land properly fertilized and not on soil impregnated with great quantities of organic nitrogen, i.e., fertile lands.

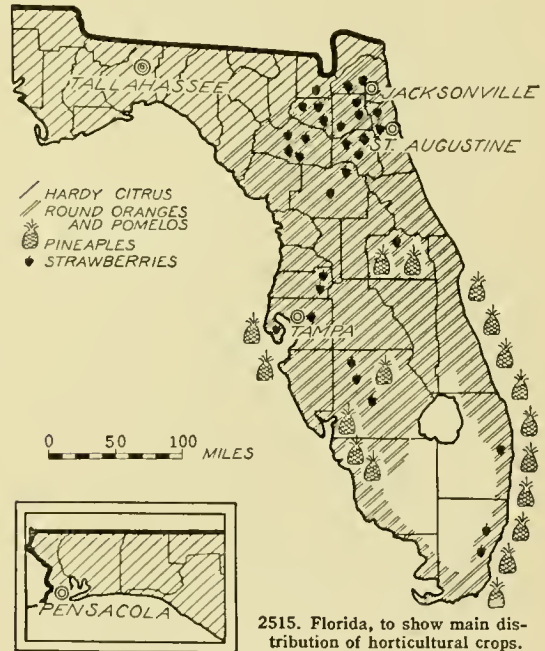
In building up the land from the ocean bed, referring especially to peninsular Florida, the wind and waves have sorted the particles to some extent and have elevated various parts more than others. The separation of the larger particles of sand from the finer, with a porous substratum, has produced what is called a "scrub." The railroad surveys indicate that the maximum elevation in peninsular Florida is about 300 feet. Thus it happens that, although this land is thirsty, it is rarely or never spent of its capillary moisture. The areas of scrubs may vary in size from a few acres or even less to many thousands, but they are always sharply defined, having a specialized flora. The soil in a hammock is of a finer texture and is not infrequently underlaid by clay. It often occurs that land of this texture is only a few feet above sea-level, or it may be elevated and rolling, but is always covered with a good growth of hardwood or of cabbage palmetto, or both. This class of land has long been desirable for horticultural purposes, and is still regarded as valuable. These regions are more or less isolated, and vary in extent. Such land usually contains sufficient fertility to raise several crops of vegetables. Flat woods land is usually level, varying in fertility from 96 per cent of sand and insoluble matter to that which will produce a crop of tomatoes. This class of land comprises about seven-tenths of the land of the peninsula. With proper treatment it raises good crops and is capable of remarkable improvement. The characteristic plant of this land is the long-leaved pine.

The foregoing discussion relates to the state indepen-

dent of latitude and climate. The state is also divided into four regions, according to climate and latitude: (1) western Florida, that part of the state lying west of the Aucilla River; (2) eastern Florida, that part of the state lying between the Aucilla River and a line drawn from the mouth of the St. John's River to Cedar Keys; (3) central Florida, that part of the state lying between eastern Florida and southern Florida; (4) southern Florida, including the counties of Brevard, St. Lucie, Palm Beach, Dade, Monroe, Lee, DeSoto and Manatee.

Citrous fruits develop best on hammock and rolling pine land, preferring the cabbage palmetto hammocks or a hammock containing a mixture of palmetto and hard wood. The lime alone does well on the shell and coquina lands of southern Florida. The rough lemon stock is preferred in southern Florida, especially on the higher sandy lands. For western Florida the Satsuma orange is the best variety. For eastern Florida varieties that mature their fruit before Christmas may be planted. In central Florida all the varieties of Citrus do well, especially toward the south and in protected localities.

Peaches grow in all sections, preferring hammock or rolling pine land or even level pine land if perfectly drained, but the varieties best adapted to different regions vary considerably.



2515. Florida, to show main distribution of horticultural crops.

Plums, as a whole, are adapted only to western and eastern Florida, preferring hammock and rolling pine land. Burbank does well in the western section. In the eastern section Terrill, Botan and Burbank do well.

Of the pears, Kieffer, LeConte, and Smith do well in western and eastern Florida on hammock or rolling pine land.

Grapes grow rapidly, but need careful attention to be kept in good bearing condition for a period of years. Hammock land is preferable for them. The native varieties grow to an immense size and produce great quantities of fruit with minimum attention. Of *Vitis rotundifolia*, the Scuppernon and Thomas grow luxuriantly in all sections. Flowers grow well in western and central Florida.

The kaki, Japanese persimmon, needs good hammock land or well-drained high, or more or less undulating,

rolling pine land. It is better adapted to western, eastern and central than to southern Florida.

Under favorable conditions, Jennings and Red Astrachan apples may be fruited in western Florida; Santa F  apricot in western and eastern Florida. Figs do fairly well for home use and for canning or candying in eastern and central Florida. They need a compact, fine-textured soil.

Mulberries will grow on hammock or good quality of rolling pine land in all sections of the state. The following varieties have given good crops: Downing, Hicks and Stubbs. Pomegranates make a more or less ornamental fruit. Acid, Purple and Sweet do well in western, eastern and central Florida.

Pecans are adapted to various kinds of soils, especially from central Florida northward and westward. The best agricultural lands such as are considered the most suitable for the growing of cotton are best adapted to pecan-growing. The best stock on which to grow pecans is the pecan seedling. Much time and money has been lost in attempting to bud native species of hickory already established in the hammocks to pecans. While it is possible to secure good bearing trees in this way, it is usually financially unsuccessful. Leading varieties are the Curtis, Frotcher, Russell, Stuart, and Van Deman.

The growing of strawberries is controlled largely by efficient and reasonable transportation. If the crop cannot be placed upon the market promptly it is worthless. Probably nine-tenths of the fields of the state are planted on moist flat woods land, or what is locally known as gall-berry flats. Such land is cleared and thoroughly drained by means of open ditches. On such land strawberries begin to ripen in January and continue until May or June if properly cultivated, though the season of profitable shipment rarely extends beyond the middle of April. Especially prepared refrigerator cars are now carried by some railroads on express trains. The plants are usually set out every year, in August, September and October, and bear a good crop the following spring. The most successful strawberry growers continue to cultivate a part of the old field to secure new plants to be used the following fall for planting out the new field.

Pineapples find their most congenial habitat on spruce pine land. Soil from pineapple fields contains a large percentage of sand and insoluble matter,—as high as 98 per cent. The land must be well drained, free from any standing water, even during the rainy season. The most extensive pineapple area is located on the sand hills near the coast. The character of the vegetation and physical condition of these hills or dunes is essentially that of the scrub land of the interior. The slat sheds or pineapple sheds, which are constructed to afford a half shade, serve a good purpose in summer as well as in winter. In summer the slats reduce the amount of sunshine that reaches the plants and consequently the intensity of heat, though probably not the total warmth. In winter they interfere with rapid radiation, which would occur as the result of a sudden freeze or of a frost. The slat shed is a simple structure, the essential part of it being the roof or covering, which is made of boards or slats fastened so as to leave an opening between the boards or slats equal to the space covered by them. These vary in size from a common plastering lath to boards 4 inches wide. The height of the covering above the ground varies from 6 feet to rarely more than 10. The most extensive fields are located in southern Florida. Smaller areas have been planted in central Florida; nearly all of these are protected by sheds, some of the sheds being so constructed that the roof may be closed completely. The islands or keys underlaid with coralline limestone form one of the most suitable habitats for this plant, while the low, fertile islands or keys are worthless for a pineapple plantation. Red Spanish is cultivated more extensively

than all the other varieties combined. It is a hardy variety, and one suited to extensive planting with a minimum amount of attention. For extensive culture, Egyptian Queen, Porto (Puerto) Rico and Ripley Queen do well generally. Smooth Cayenne is promising, because not spiny.

Bananas are cultivated only for local markets, but form a source of considerable revenue to a number of plantations. The land best adapted to them is a low, moist hammock or a bay head, especially such soil as is composed largely of muck. Bara oa (Red Jamaica), Cavendish, Golden, Hart's Choice and Orinoco ("horse banana") are leading varieties in southern Florida.

The guava has attained considerable importance, though as yet it is not cultivated extensively. Plantations exist in various parts of the state, but the greater quantity used in canning and for jelly is collected from trees grown without cultural attention. Nearly all of the fruit is from seedlings that have originated from scattered seeds. Well-drained fertile soils are favorable locations, but the guava adapts itself to almost all classes of cultivated soil. The sweet varieties are preferred for dessert, while the sour kinds produce the largest amount of jelly. The total amount of jelly and other guava products produced in the state will amount to many carloads annually. The Cattle and Strawberry guavas, while more cold-resistant and delicious as fresh fruit, are less popular than the varieties derived from the American species.

Mangoes are being grown extensively for the northern markets. They are now being fruited in the southern part of central Florida. The large extension in production of this fruit, however, will take place throughout southern Florida, mainly toward the southward. Orchards of considerable size are being planted to budded varieties from India together with budded varieties that have originated in Florida. Some of these varieties that have originated in Florida from the seed of Indian varieties, appear to have better fruiting qualities than their parents. Good citrus soil is preferred for growing mangoes. The same cultural care that proves best for citrus fruits is also applicable to the mango. The fertilizer requirements of the mango are very similar to those of Citrus. Among the old seedling varieties, No. 11 is a favorite on the east coast, while seedlings belonging to the Bombay group appear to be more frequently planted on the west coast. Among the budded Indian varieties, Mulgoba has been most extensively planted. It has, however, proved disappointing in its productiveness, though the fruit has no superior. Sandersha has become well established. Cecil, belonging to the Cambodiana group is very productive and a favorite. A large number of varieties in the form of inarched trees, have been imported. These are now fruiting and in the course of the next decade or two there will be considerable opportunity for selection from the best of these.

Coconuts are confined to southern Florida and along the seacoast. While the trees continue to grow when transplanted to the higher lands, they need the low, moist lands of the coast for fruiting and for highest development.

The avocado is a salad fruit of American origin, having been cultivated by the Incas, by whom it was called "ahuacatl." Up to twenty years ago, little effort had been made toward propagating improved varieties of this fruit. With the settlement of extreme southern Florida came a rapid development in its propagation by budding. This is carried on almost as easily as in the case of citrus. A careful survey of the trees fruiting in south Florida in 1903 showed that about 3 per cent of the seedling trees bore commercially profitable crops. Budded varieties of the avocado may now be secured from the leading nurserymen in southern Florida. The range of bearing trees is northward to the southern part of central Florida. The leading varieties



LXXIII. North American horticulture.—An orange grove in Florida.

are Trapp for December and January fruit; Baldwin and Early for July fruit; Pollock for large mid-season fruit; and Family for a succession of fruits from the latter part of July until into October. The bulk of the seedling fruits mature from the latter part of July until the middle of October. The hard-shelled Guatemalan fruits introduced by the Department of Agriculture, ripen in February and March. The small Mexican avocados that produce bluish fruits are hardy to the northern limits of central Florida, but are not commercially valuable.

Almost the entire list of vegetables given in the seed catalogues may be grown in all parts of the state. The industry has now developed until it is competing closely for first place with citrus fruits. Originally the hammocks were preferred for the main production of truck crops. In more recent years and with the advent of extensive drainage systems, the level lands composing the flat-woods and drained areas have been planted to vegetables extensively. Watermelons, cantaloupes and cucumbers are grown mainly on the hammock or high pine land. Cabbage, cauliflower, beets and similar vegetables are most largely grown on the heavier, more compact soils. Celery is grown most extensively on level tracts, much of which were formerly under water. These tracts permit sub-irrigation, which may be cheaply carried out in the areas of artesian flow. Vegetables are now produced to greater or less extent on almost every character of soil in the state, including even some spruce-pine land, some of which by means of commercial fertilizers has been made productive of truck crops.

Truck-growing can be developed extensively only where an abundance of skilled or fairly skilled labor can be commanded at critical periods. As truck-growing does not employ the grower's attention for more than six months in the year, this labor must be able to find additional employment in some other way. Various centers have specialized on trucking; the Hastings center in north Florida makes a specialty of Irish potatoes; Sanford specializes on celery; the Manatee River region produces truck in general; the Biscayne Bay region produces truck for the midwinter and early spring markets.

Among the prominent horticulturists of Florida, not now living, were: Dudley W. Adams, organizer of the Florida State Horticultural Society; E. H. Hart, introducer of many ornamental and useful plants; H. G. Hubbard, who gave special attention to citrus insects; F. W. Inman, organizer of the Florida Citrus Exchange; C. T. McCarty, who at the time of his death owned the largest pineapple plantation in the world; A. H. Manville, practical horticulturist; T. W. Moore, author of "Orange Culture for Florida;" E. O. Painter, who did valuable work in connection with the Horticultural Society; Rev. Lyman Phelps, by some called "the father of chemical fertilizing for citrus fruits in Florida"; Stephen Powers, editor of "The Florida Fruit Grower;" Phiny Reasoner (see Volume III, page 1593); and Denis Redmond, writer on horticultural subjects.

Public-service agencies for horticulture.

The Land-Grant college of Florida was established in 1883, when a site for it was selected at Lake City. In 1903 the name "Agricultural and Mechanical College" was changed by the Legislature to the "University of Florida," and in 1905 the Agricultural College was relocated at Gainesville. There is one professor of horticulture.

The Experiment Station was established in 1887 in connection with the Agricultural College at Lake City. It was removed to Gainesville on January 1, 1907. In 1906, a separate staff was appointed who were relieved from all teaching duties, thus giving their entire time to investigational work. Eleven of this staff are devoting their time to problems connected with horticulture.

About seventy-five horticultural bulletins have been issued.

An Agricultural and Mechanical College for negroes is also maintained, in which horticulture is taught.

Extension work in horticulture is carried on in connection with the college and the county agents. In twenty counties, girls' canning clubs have been organized in connection with the public schools.

In 1911, the office of State Inspector of Nursery Stock was established. This office is filled by the professor of entomology.

Statistics (Thirteenth Census).

The approximate land area of Florida is 35,111,040 acres, of which 5,253,538 are in farms, or 15 per cent of the land area. Of the farm land, 1,805,408 acres, or 34.4 per cent, are improved; 3,007,638 are in woodland; and 440,492 acres are classified as other unimproved land in farms. The number of all the farms in the state in 1910 was 50,016. The average size of a farm was 105 acres. [The total area is 58,666 square miles.]

The leading agricultural crops grown are cereals, hay and forage, cotton (including cotton seed), and tobacco. The cereals in 1909 occupied 650,486 acres, which was 36 per cent of the improved land occupied, and the value of cereal products was \$6,175,973, or 17.1 per cent of the total value of all crops. Hay and forage in 1909 occupied 54,729 acres, an increase in acreage of 148.8 per cent as compared with 1899, when the land occupied by hay and forage was 21,994 acres. Value of the hay and forage products, in 1909, was \$847,485. Cotton (including cotton seed) occupied 263,454 acres in 1909, which was 14.6 per cent of the improved land area. The value of the cotton products in 1909 was \$5,481,467, which was 15.2 per cent of the total value of all crops. The acreage of tobacco in 1909 was 3,987 acres, an increase of 93.9 per cent as compared with 1899, when it was 2,056 acres. The value of tobacco in 1909 was \$1,025,476. The value of forest products from the farms in 1909 was \$2,375,882, as compared with the value in 1899, when it was \$648,412.

Horticultural crops grown in Florida are fruits and nuts, vegetables, peanuts, flowers and plants and nursery products, and small-fruits. The value of fruits and nuts grown in 1909 was \$7,410,166, as compared with \$1,203,373 in 1899. The acreage devoted to vegetables, excluding potatoes, sweet potatoes and yams, in 1909 was 57,600 as compared with 1899, when it was 26,762. The value of the vegetable products in 1909 was \$6,314,313 as compared with \$1,954,802, in 1899. The acreage of peanuts in 1909 was 126,150, from which were harvested 2,315,089 bushels, valued at \$2,146,862. In 1909, 2,280 acres were occupied by plants and flowers and nursery establishments, an increase of 222 per cent as compared with 1899, when the number of acres thus occupied was 708. The value of these products in 1909 was \$547,280, as compared with 1899, when their value was \$163,557. The acreage of small-fruits in 1909 numbered 1,356 acres which produced products valued at \$302,383.

The total quantity of orchard fruits produced in 1909 was 235,188 bushels, valued at \$232,203. Peaches and nectarines and pears are the more important of the orchard-fruits. In 1909 the production of peaches and nectarines was 114,998 bushels, valued at \$128,029; for the same time the production of pears was 98,223 bushels, valued at \$80,119. Other orchard-fruits and their production and value for 1909 follow: plums and prunes, 17,169 bushels, valued at \$18,976; apples, 3,405 bushels, valued at \$3,849; mulberries, 924 bushels, valued at \$671; cherries, 374 bushels, valued at \$448; quinces, valued at \$103, and apricots valued at \$8.

The production of grapes in 1909 was 1,086,344 pounds, valued at \$38,357. The value of the grapes produced in 1899, 1,684,700 pounds, was \$56,420, showing a considerable decrease in value for the period.

The production of nuts in 1909 was 382,535 pounds, valued at \$47,456. The pecan was by far the most important nut, the production in 1909 being 307,632 pounds, valued at \$43,962. The production of Persian or English walnuts was, in 1909, 28,575 pounds, valued at \$2,018; that of black walnuts 42,573 pounds, valued at \$766; and 17,012 coconuts valued at \$501.

The most important fruits produced in Florida are the tropical fruits, valued in 1909 at \$7,092,150. More than half this value is contributed by oranges, and most of the remainder by pomelos (grapefruit) and pineapples. In 1909, 4,852,967 boxes of oranges were produced, valued at \$4,304,987. The production in 1899 was 273,295 boxes. The production of pomelos, or grapefruit, in 1909 was 1,061,537 boxes, valued at \$1,907,816; that of pineapples, 778,644 crates, valued at \$734,069. Other tropical fruits of importance, their production, and value in 1909 were: tangerines, 34,871 boxes, valued at \$64,082; lemons, 12,367 boxes, valued at \$13,753; limes, 11,302 boxes, valued at \$12,457; guava, 258,709 pounds, valued at \$7,604; figs, 474,287 pounds, valued at \$20,886; mangoes, 5,278 boxes, valued at \$5,739; bananas, 10,048 bunches, valued at \$5,638; avocados, 4,920 crates, valued at \$10,100; and also kumquats to the value of \$2,768; and Japanese persimmons, valued at \$2,066.

Of the small-fruits raised in Florida, strawberries are the only one raised on a considerable scale. The total acreage, production, and value of small-fruits in Florida in 1909 was: 1,356 acres; 2,396,573 quarts; and \$302,383. Of strawberries alone, there were 1,343 acres, which produced in 1909, 2,383,397 quarts, valued at \$301,056. Blackberries and dewberries contributed \$1,287 toward the total value of small-fruits; raspberries and loganberries \$25; and currants \$15.

Of the vegetables grown in 1909, the most important in value were the tomato, sweet potatoes, yams, and potatoes. The product from 12,338 acres of tomatoes in 1909 was valued at \$1,839,233. The production of sweet potatoes and yams in 1909 was 2,083,665 bushels, valued at \$1,231,238; the production of potatoes was 856,967 bushels, valued at \$839,691. Other leading vegetables were: 5,013 acres of green beans, valued at \$483,927; 3,028 acres of cabbage, valued at \$434,558; 3,408 acres of cantaloupes and muskmelons, valued at \$230,009; 825 acres of celery, valued at \$417,578; 2,086 acres of cucumbers, valued at \$354,770; 1,450 acres of lettuce, valued at \$343,456; 296 acres of green peppers valued at \$94,246; and 17,711 acres of watermelons, valued at \$394,567. Other vegetables of less importance grown in Florida are asparagus, beets, cauliflower, sweet corn, eggplant, okra, onions, green peas, squash and turnips.

The acreage devoted to the production of flowers and plants in 1909 was 49; in 1899 it was 45 acres. The value of the products from flowers and plants was \$69,106 in 1909; the value from these products was \$41,417 in 1899. The total area under glass in 1909 was 711,787 square feet. Of this, 568,190 were covered by green-houses and 143,597 by sashes and frames.

The acreage used in the production of nursery products was 2,231 in 1909, as compared with 663 in 1899, showing an increase in acreage of 236.5 per cent. The value of the nursery products in 1909 was \$478,174, as compared with \$122,140 in 1899.

P. H. ROLFS.

EAST SOUTH CENTRAL STATES.

Kentucky.

The state of Kentucky (Fig. 2516), while its interests have not been largely directed, in the past, toward the field of horticulture, is nevertheless, in its various parts, admirably adapted to nearly all the fruits and vegetables of the temperate zone, a fact which during the past decade or more, has been increasingly recognized.

Its agriculture has been primarily concerned with the practices of general farming and live-stock production rather than with the more intensive requirements of fruit- and truck-growing.

Before the Civil War, the people of wealth and culture, in common with those of other classes, lived chiefly in the country rather than in the towns, which were small and comparatively unimportant. There are evidences yet remaining, in numerous old and stately country homes, surrounded by magnificent trees and old-fashioned gardens, to bear witness to the high appreciation of the people of those early days for the amenities of rural life. Even today, though the movement toward the town is here, as elsewhere, apparent, Kentucky is practically a rural community. With the exception of Louisville, all of its cities are still of modest size, the interests of whose people are closely interwoven with those of the country districts round about.

In the early years, therefore, there was little to stimulate the growth of commercial horticulture, but with the steady advance in fruit-growing throughout the country, and particularly as a result of better transportation facilities for perishable products, there have been developed, in recent years, several fruit- and vegetable-growing areas in which these industries have assumed extensive proportions. Broadly speaking, these areas may be said to include a more or less continuous band of territory of varying width, along the northern boundary of the state bordering the Ohio River down to its confluence with the Mississippi. A second region of horticultural importance includes a belt of counties lying to the south and southwest of Louisville, extending as far as Warren and adjacent counties in the southern part of the state.

Among the more notable of these centers of fruit-production is the Henderson apple district including Henderson and parts of the neighboring counties which have proved to be peculiarly adapted to the production of the Winesap apple. This variety has been more extensively planted in this section than any other kind, and being held in cold storage until the later winter months when other varieties of high quality have become scarce, finds a ready market at good prices, much of the product being shipped to southern cities. The interests of the community being centered largely upon this one fruit, there has naturally developed an organization for coöperation which has resulted in great economies in the purchase of spraying material and other supplies, though not as yet, in marketing the crop.

In this same region, also, along the bottom-lands more or less subject to annual overflow from the Ohio River, there is the promise of a new industry for this latitude in the growing of select varieties of the pecan. Upon both the Indiana and Kentucky shores of the Ohio, in this locality, are numerous groves of native pecan trees of great size, vigor, and productiveness. Here and there individual trees of great merit have been discovered which produce nuts of high value, from the standpoint of flavor, thinness of shell, size, and continuous productiveness. Some of these have been propagated by specialists who have discovered new and simpler methods for their multiplication, and are now being offered by nurserymen along with choice varieties of apples and peaches. Thoughtful students of this subject predict that here in Kentucky, as well as in the South, there is to be a large and important development of this horticultural industry.

Another fruit industry has sprung up during the past eight years in the strawberry-growing district in and around Warren County, with Bowling Green as its center. Here there is maintained a strong coöperative organization which has been so efficiently managed for the benefit of the growers that the strawberry area has increased from 55 acres the first year, to over 1,000 in 1914, with a large increase in prospect. After trials

with various standard sorts, the Aroma has proved to be the most valuable kind for the soil and market conditions of this district, and is now grown almost exclusively, being shipped in carlots to many northern and eastern cities at prices which, upon the average, have proved very satisfactory to the producer. The yield is about 150 crates (24 quarts) an acre, although occasional yields of 200 crates are found, while a yield as high as 250 crates has been produced in a very few instances.

The county of Jefferson, containing the largest city of the state, Louisville, is the center of a district which is horticulturally important for both its fruit- and truck-growing interests. Owing to the proximity of the city, market-gardening has naturally extended to large proportions. Peaches and other orchard-fruits are profitably grown, but the district has become particularly noteworthy for two specialized industries, the growing of onion sets and second-crop potatoes. While a considerable area of early potatoes is produced under ordinary methods, the growing of the second crop is a unique industry which had its beginning in 1882, and has developed gradually until, in 1914, there were about 11,000 acres planted in the crop, giving a total yield of about 700,000 barrels. The second crop is planted between July 15 and August 1, and harvested in October. There are two coöperative organizations in the county which market most of the crop. A portion of the crop is held each year in cold storage for seed purposes. The varieties chiefly grown are the Carman No. 3, and to a less extent, the Irish Cobbler as seed stock for the usual first crop.

In the hill country to the south and southwest of Louisville, apple- and peach-growing has for years been an important business, while to the northeast the peach orchards of Trimble County have for twenty years and over been a prominent feature. Throughout much of the fruit area mentioned, as in other parts of the state, the most favorable results are secured when advantage is taken of elevated locations, and of the cold-air-drainage resulting from the numerous deeply eroded river-channels.

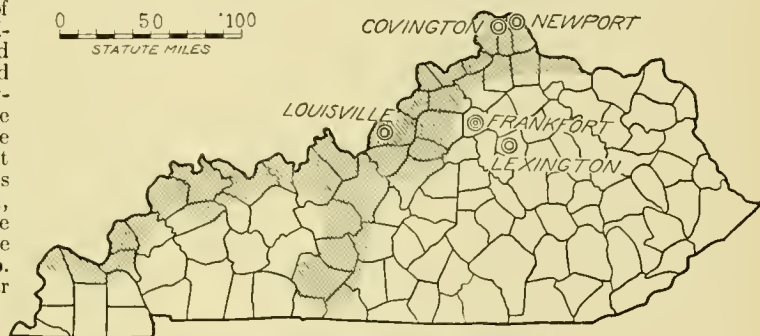
In the vicinity of Cincinnati, Ohio, the fruit- and vegetable-growing interests are of considerable importance, although the conditions for market-gardening have resulted in a greater development of that business upon the northern than upon the Kentucky side of the Ohio River.

About two-fifths of Kentucky, comprising the entire eastern end of the state, is a mountainous country, rich in coal and other minerals, in which agriculture is confined, for the most part, to a few staple farm crops, which are produced, in many cases, by primitive methods, and with scanty returns. With the penetration of many new railroads into the heart of this vast area, and the opening of extensive mining enterprises, there is coming a fresh realization of its great fruit-growing possibilities. Here and there enterprising individuals have established orchards and gardens, thus showing the possibility of producing the fruits and garden products abundantly. For most of these products, there is an eager home market in the growing mining towns, and when the home demand is supplied, there are now numerous outlets to the larger markets of the cities.

The larger part of the public park areas of the state are located in Louisville, which now has a valuable series of such parks comprising a total of over 1,500 acres which, since their establishment about 1890, have been vigorously developed under the direction of

the most skillful landscape architects. Until recent years, the small cities of the state, on account of their moderate size, have not so keenly felt the need of such public recreation grounds, but with added growth, they are now, for the most part, realizing this need and taking steps to supply it. The cities of Lexington, Owensboro, Covington, Henderson, Paducah, and others have already acquired, and have in use, various tracts of land to serve as a nucleus for further developments in this direction.

Of other public grounds in which the work of the landscape horticulturist is manifest, the two cemeteries, Cave Hill, of Louisville, and that of Lexington are perhaps the most notable examples in the state. The former comprises an area of about 300 acres, and is situated upon a beautiful tract of land, elevated 100 feet above the Ohio River. It contains several beautiful lakes, and is especially rich in its collections of



2516. Kentucky, with the horticultural parts.

aquatics. The cemetery at Lexington contains over 160 acres, and was established in 1849. It was exceptionally fortunate in being under the same superintendent, the late Charles S. Bell, from the beginning through a period of fifty-six years, and in having the landscape method of treatment followed from the first. Among many interesting horticultural features, the most notable today are the magnificent old bur oaks, white elms, and other trees, many of which are from 3 to 5 feet in diameter.

There is not yet full appreciation among Kentuckians of the remarkable resources in trees, shrubs, and herbaceous plants growing within the borders of the state, a flora so rich and varied that a fully satisfying scheme of landscape planting might anywhere be developed with access only to the native species. The widely varying conditions of soil, altitude, and climatic conditions, ranging from the high uplift of the Alleghanies in the east to the low bottom lands lying along the Ohio and Mississippi rivers in the west, have resulted in a natural assemblage of many of the finest tree and shrub species growing in North America. A list of the woody plants of Kentucky recently issued by the botanical department of the State Experiment Station (Bulletin No. 169) records the presence in Kentucky of twelve species of the Coniferae, ten of willows, six of ash, seven hickories, nineteen oaks, five elms, and four magnolias. In addition to these, there are numerous other species in great profusion, including such interesting and valuable kinds as the tulip poplar (tulip tree), sycamore, the butternut and black walnut, sweet gum, eypress, the rare and beautiful yellow-wood (*cladrastis*), holly, dogwood, and red-bud, together with the rhododendrons, laurels, and numerous other shrubs of smaller stature.

Among the wild fruits and nuts, the black walnut is probably the most widely distributed and attains a large size in Kentucky, having long been the source of a valuable timber-supply. The nuts, while occasionally

quoted in the general markets and extensively gathered for local consumption, have been prevented from coming into wide popularity because of their heavy shell and rather strong flavor. A fresh interest in this nut tree has been awakened through recent occasional reports of successful attempts to grow certain varieties of the English or Persian walnut by grafting them upon the common species. The shellbark and other hickory-nuts are produced freely in all parts of the state. The chestnut is also widely distributed, but is more abundant in the less fertile parts of the state.

Among other wild fruits of interest from the horticultural standpoint may be mentioned the persimmon and pawaw, both of which grow commonly over most parts of the state, and are offered for sale to a limited extent in the late autumn months. As trees of both these species are sometimes found possessing fruits with fewer seeds, improved flavor, or other favorable variations, there is reason for expecting that much improvement may ultimately be secured.

Nurseries are scattered over most parts of the state, there being about forty in all, varying from extensive business enterprises with many employees to the little plot of an acre or less that is usually conducted by an orchardist for the propagation of a few trees for his own use.

Except in the larger cities and towns, commercial greenhouses are few, although in the hands of a number of enterprising individuals the results of growing both vegetables and flowers under glass have been very successful, and shipments of such greenhouse products are often made to other states. With a superabundant supply of valuable coal, there must inevitably come a better appreciation of the abounding opportunities for the development of such undertakings.

Public-service agencies for horticulture.

In common with other states, Kentucky enjoys the advantages of a College of Agriculture and Experiment Station, both of which are established as departments of the State University at Lexington. Horticultural education is given due recognition in its agricultural courses, and through cooperation with its Extension Division, with the State Board of Agriculture, and with the newly organized agency of County Advisers, is being effectively carried to the people.

The two state normal schools, located at Richmond in the east and Bowling Green in the west, are both actively engaged in promoting horticultural education.

The State Horticultural Society has had a long and varied history of over sixty years, being established in 1850. Never a large organization, and without financial aid from the state or other external sources, it has exerted an influence, with its little band of enthusiastic supporters, far out of proportion to its membership.

All the nurseries of the state are subject to annual supervision by the inspector of the State Experiment Station as a safeguard against the dissemination of dangerous insects and fungous pests.

Statistics (Thirteenth Census).

The approximate land area of Kentucky in 1909 was 25,715,840 acres. The land in farms was 22,189,127 acres or 86.3 per cent of the land area. The improved acreage in farms numbered 14,351,471; the acreage in woodland 6,951,626; and other unimproved land 883,630. In 1910 there were 259,185 farms in the state, the average acreage being 85.6. [The total area is 40,595 square miles.]

The leading agricultural crops of Kentucky are cereals, tobacco and hay and forage. In 1909 the production of cereals, from an acreage of 4,323,702, was valued at \$60,738,651, which was 43.7 per cent of the total value of crops. The tobacco produced from 469,795 acres for the same year was valued at \$39,868,753; and the hay and forage produced from 966,377

acres was valued at \$10,306,311. While the value of the cotton produced in 1909 was only \$246,614, the acreage increased from 2,396 acres in 1899 to 7,811 in 1909, an increase of 226 per cent. In 1909 there were also produced sugar crops to the amount of \$1,420,504. The value of the forest products of farms was \$7,843,142 in 1909, as compared with \$4,179,480, in 1899.

The horticultural crops grown are fruits and nuts, small-fruits in limited amounts, vegetables including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts in 1909 was \$4,661,634, as compared with \$2,064,360 in 1899. The acreage of small-fruits decreased from 6,126 in 1899 to 4,387 in 1909, when the production was 4,972,702 quarts, valued at \$357,597. In 1909 the total acreage of potatoes and other vegetables was 182,639 and their value \$11,850,994, a decided increase over acreage and value in 1899. The raising of flowers and plants and nursery products was important, 791 acres being devoted to them in 1909, and the output valued at \$508,372.

The total quantity of orchard-fruits produced in 1909 was 9,447,858 bushels, valued at \$4,506,950. Apples contributed more than three-fourths of this quantity and peaches and nectarines most of the remainder. The production of apples in 1909 was 7,368,499 bushels, valued at \$3,066,766. The number of apple trees of bearing age in 1910 was 5,538,267; those not of bearing age numbered 2,106,297. The production of peaches and nectarines in 1909 was 1,623,379 bushels, valued at \$1,062,138. The number of peach and nectarine trees of bearing age in 1910 was 2,245,402; those not of bearing age, 1,110,744. The more important of the other orchard fruits produced in 1909 were: 251,536 bushels of pears, valued at \$187,951; 139,346 bushels of plums and prunes, valued at \$102,446; 52,163 bushels of cherries, valued at \$74,340; and 11,537 bushels of quinces, valued at \$11,757.

The number of grape-vines of bearing age in 1910 was 605,002; those not of bearing age, 77,626. The production in 1909 was 3,680,182 pounds, valued at \$137,326. The production of grapes in 1899 was 5,134,215 pounds.

Of the nuts grown in 1909, the black walnut is by far the most important. The production of black walnuts was 793,970 pounds, valued at \$11,384; that of pecans, 28,577 pounds, valued at \$2,887; that of Persian or English walnuts, 35,825 pounds, valued at \$1,499; that of chestnuts 16,619 pounds, valued at \$714; and that of hickory-nuts, 71,347 pounds, valued at \$735.

Blackberries and dewberries are the most important of the small-fruits raised in Kentucky, with strawberries and raspberries ranking second and third, respectively. The acreage of blackberries and dewberries increased from 1,024 in 1899 to 2,141 in 1909, when the production was 2,165,547 quarts, valued at \$137,250. The acreage of strawberries decreased from 4,128 in 1899 to 1,553 in 1909, when the production was 2,114,929 quarts, valued at \$159,765. In 1909 the production of raspberries was 558,529 quarts, valued at \$50,472; that of gooseberries 118,338 quarts, valued at \$8,661; and that of currants 15,159 quarts, valued at \$1,429.

Of the vegetables grown in Kentucky the potato is the most important. In 1909 the production from 55,750 acres was 5,120,141 bushels, valued at \$2,724,043. The acreage devoted to the sweet potato and yam produced, in 1909, 1,326,245 bushels, valued at \$839,454. The acreage of all the other vegetables in 1909 was 115,007, and their value \$8,287,497, both acreage and value being an increase over 1899. The more important of the other vegetables grown in 1909 were: 1,959 acres of onions, valued at \$200,317; 3,574 acres of tomatoes, valued at \$128,017; 5,041 acres of green beans, valued at \$91,663; 1,690 acres of watermelons, valued at \$70,144; 738 acres of cabbage valued at \$63,288; 1,103 acres of sweet corn, valued at \$35,758; and 594 acres of cantaloupes and muskmelons, valued at

\$35,172. Other vegetables grown were asparagus, beets, celery, cucumbers, kale, lettuce, rhubarb, spinach and turnips.

The acreage devoted to the production of flowers and plants increased from 132 in 1899 to 249 in 1909, an increase of 88.6 per cent. The area under glass in 1909 was 1,363,002 square feet, of which 1,276,823 were covered by greenhouses and 86,179 by sashes and frames. The value of flowers and plants produced in 1909 was \$392,409, as compared with \$262,288 in 1899.

The acreage devoted to nursery products, on the other hand, decreased from 837 in 1899 to 542 in 1909, when the value of the products was \$115,963, as compared with \$114,749 in 1899. C. W. MATHEWS.

Tennessee.

The horticultural products of Tennessee (Fig. 2517) are greatly diversified on account of the varied soil and climatic conditions. A knowledge of the natural divisions of the state is essential to a thorough understanding of its adaptability to the various branches of horticulture.

The Unaka region, on the eastern border, contains about 2,000 square miles. A few of the peaks are over 6,000 feet above sea-level, and the average elevation is 3,000 feet. The soil is gravelly and thin, but contains areas that are fairly productive. Apples are grown to a limited extent.

The valley of East Tennessee is the next division. It contains 9,200 square miles and an average elevation of 1,000 feet. The soils are generally well adapted to fruits. Records taken at Knoxville during a period of forty-four years show an average annual rainfall of 48.73 inches. Strawberries are extensively grown for northern markets in Hamilton, Rhea, Roane, Blount, and Knox counties; commercial peach orchards in Rhea, Roane, Washington, and Bradley counties; there are few large apple orchards, but farm orchards indicate success in commercial orcharding.

A thousand feet above the valley of East Tennessee lies the Cumberland Tableland, containing 5,100 square miles. This section, for the most part, is poor, the soils being sandy and thin. There are, however, areas of land which produce fruits and vegetables of the highest quality. An apple and peach orchard of over 400 acres in Morgan County is the largest in the state. Irish potatoes of superior quality are an important crop in Cumberland County, and, with proper fertilizing, can be grown with profit in all parts of the plateau. The climate is particularly healthful.

West of the Cumberland Tableland is the Highland Rim, surrounding the Central Basin. The Rimlands have an area of 9,300 square miles and an average elevation of nearly 1,000 feet. This territory possesses a great variety of soils, some of which are highly fertile and well suited to orcharding. Numerous streams cut the land into valleys, which are generally deep and narrow.

The Central Basin, in which Nashville is situated, contains 5,450 square miles, with numerous elevations of 200 to 300 feet above the general level. The soil is fertile and well adapted to small-fruits and vegetables. The average rainfall at Nashville is 49.53 inches. The largest commercial apple orchards of the state are located in this section, in Maury and Williamson counties.

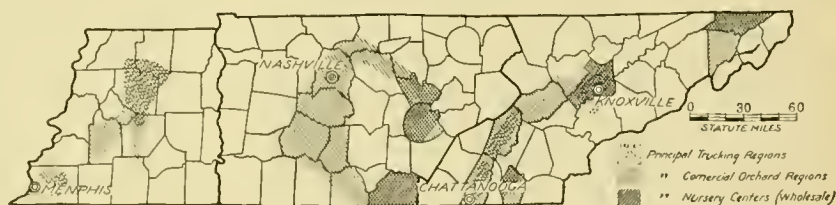
The next natural division is the valley of the Tennessee River. It has an elevation of about 360 feet and an area of 1,200 square miles.

The Plateau, or Slope, of west Tennessee is the most important horticultural region commercially in the state. It contains 8,850 square miles and has an average elevation of 500 feet. The soils are generally light, fertile and easily cultivated, but demand careful treatment to prevent serious damage by washing. There are extensive commercial orchards of apple and peach in Haywood, Weakley, Gibson, and Madison counties, but the principal horticultural products are truck crops of strawberry, tomato, early and second-crop Irish potato, lettuce, cabbage, pepper, and sweet potato. Humboldt is the principal center of the trucking industry, which is rapidly developing.

The last natural division, the Mississippi bottoms, has an area of 950 square miles and an average elevation of 295 feet. It is little used for horticultural purposes.

The possibilities of Tennessee for the cultivation of fruits and nuts are evidenced by the profusion of these products in a wild state. Wild strawberries are found thoroughly distributed. Blackberries thrive everywhere. In favorable localities they attain a very large size, surpassing in this respect some of the cultivated varieties. Wild blackberries are marketed in large quantities in many sections, but only the earliest named varieties are desirable for shipment. Red and black raspberries grow in most parts of the state; and in some sections the best of the wild blackcaps, when transplanted to the garden, give better results than any of the cultivated varieties. In cultivation, the raspberry succeeds best when heavily mulched. Wild grapes abound throughout the state. Plums are also found in profusion; and the Wild Goose variety is said to have originated in Tennessee. Other wild fruits are: dewberries, cherries, crab-apples, juneberries, pawpaws, persimmons, and huckleberries.

Of the nuts, chestnuts are most plentiful, especially in the hilly and mountainous sections. The chinkapin flourishes in east Tennessee. Black walnuts are exceedingly numerous. Hickory-nuts are common throughout the state. Pecans are native along the streams, attaining great size in the Mississippi bottoms, but the thin-shelled named varieties have not been generally successful. Hazel-nuts, and butternuts, or white walnuts, are also plentiful.



2517. Tennessee, marking the horticultural areas.

Some of the native seedling fruits are highly valued, especially apples, peaches and strawberries. Many well-known varieties introduced from other states are not satisfactory. This is especially true of winter varieties of the apple, of which the introduced kinds are not so well adapted to the climate and soils as those of local origin. This fact is becoming well established among practical horticulturists. It is only a few years since orchardists were planting varieties of winter apples originated in the North. After repeated failures to get first-class fruit of good keeping qualities, they have begun to use native seedling varieties. Some of them will doubtless be largely cultivated in the future. A few native varieties of winter apples have gained considerable popularity among commercial orchardists. The fruits of these sorts have commanded remunerative prices in competition with apples shipped from the North. Owing to the great diversity of soils and expo-

tures in this state, it is very important to select varieties that are adapted to the conditions where the trees are to be planted. The fact that a desirable apple has been originated in east Tennessee is no proof that it will succeed well in all parts of this political division. On the contrary, it is likely to give good results only in certain soils and on certain exposures that are requisite for its proper growth and fruitfulness.

All the classes of fruits commonly grown in the northern half of the United States are produced in Tennessee for home and commercial purposes. Strawberries are shipped more largely to distant markets than any other fruit. The area in peaches is increasing rapidly. Summer apples are shipped from several sections.

Of the vegetables, tomatoes and Irish potatoes are the most important commercially. The following counties have been active in producing and shipping fruits and vegetables: Gibson, Weakley, Madison, Haywood, Shelby, Maury, Williamson, Lincoln, Hamilton, Rhea, Roane, Morgan, Bradley, Washington, and Knox. Peanuts are grown largely in Perry, Humphreys, Benton, Decatur, Hickman, and Wayne.

Many locations in East Tennessee are peculiarly well adapted to the culture of grapes. This is shown by the large exhibits of fine grapes made at the fall horticultural meetings. The local markets are well supplied with home-grown grapes during their season.

Such fruits as Japanese persimmon and English walnut have not been generally successful, though occasional trees that are healthy and productive are known in the state. The Paragon chestnut is a promising variety grafted on native stock. These fruits, and thin-shelled pecans, while offering little to the practical orchardist, are of interest to the amateur. The currant and gooseberry succeed only in the high mountains of east Tennessee, and in favored localities on the Cumberland Plateau.

The nursery business is extensively developed in Tennessee, the apple, peach, pear, and cherry being largely propagated. There are 695 nursery firms listed in the office of the State Entomologist, and about one-third of them are wholesale growers. The largest nursery interests are in Franklin, DeKalb, Warren, Bradley, Knox, and Sullivan counties.

The climate of Tennessee, with moderate temperature and abundant rainfall, is favorable for the growth of ornamental plants, and landscape gardening may be extensively developed in all parts of the state, the principal drawback being the difficulty of maintaining a luxurious growth of lawn grasses. In west Tennessee, Bermuda is more largely used than any other grass. Kentucky blue-grass is most successful in the Central Basin and can be well grown throughout middle and east Tennessee by the free use of lime and fertilizers.

No state in the Union, with the possible exception of North Carolina, has a greater number of indigenous woody plants. Among native deciduous trees the following are adapted to street, lawn and park planting: large trees—white elm, winged elm, sweet gum, black gum, black locust, honey locust, silver maple, scarlet maple, sugar maple, white ash, blue ash, bald cypress, shagbark hickory, pecan, basswood (lign), beech, gray birch, chestnut, catalpa, hackberry, black wild cherry, black walnut, Kentucky coffee tree, cucumber tree, tulip (poplar), sycamore, and the following oaks: black, willow, pin, red, Spanish, scarlet, post, chestnut, white; small trees—junberry, sourwood, silver bell, hornbeam, water beech, Hercules' club, buckthorn, red-bud, yellowwood, fringe, wild plum, wild crab-apple, flowering dogwood, umbrella tree, witch hazel, hawthorn, black haw, red mulberry, sassafras, hop tree. The following native shrubs are of value for ornamental planting: bladder-nut, stewartia, callicarpa, calycanthus, yaupon (deciduous holly), flame-colored azalea, pinxter flower, mock-orange, meadow-sweet, nine-bark, red

ozier dogwood, flowering raspberry, elderberry, sumach, Carolina rose, pink-flowering locust, spice bush, wahoo, strawberry tree, coral-berry. *Kalmia*, *rhododendron* and *leucothoe* occur abundantly in the mountain sections, but they cannot be well grown in the lowlands. Of native conifers the shortleaf pine, Jersey pine, pitch pine, red cedar and Carolina hemlock should be extensively planted, though seldom used in landscape work, with the exception of the red cedar. Holly is indigenous along the streams, and is largely used in ornamental planting. Difficulty is experienced with the more common coniferous forms, such as are listed by nurserymen, except in the mountains. In the lowlands, the spruces and firs, and the white, Scotch and Austrian pines are short-lived, though sometimes growing vigorously to an age of fifteen to thirty years. Junipers, thuyas, *retinosporas* and *arbor-vites* are extensively planted and give satisfaction when skillfully cared for. Among broad-leaved evergreens, holly, *Magnolia grandiflora*, several varieties of box, abelia, mahonia, *Elaeagnus Simonii*, and a few other forms grow well in almost all parts of the state. *Azalea indica* and *A. amara* have been planted in city gardens, but have not proved successful. All the common hardy flowering shrubs grow luxuriously throughout Tennessee. In almost all parts of the state all classes of roses can be grown in gardens except the more tender teas. In the southwest part of the state such tender varieties as the Marechal Niel grow well with a little protection.

Hardy herbaceous plants are largely grown in Tennessee gardens, and their popularity is rapidly increasing. Among plants of this class, the following are recommended for all parts of the state: narcissus, tulip, hyacinth, *Lilium tigrinum*, *L. candidum*, *L. speciosum*, *L. auratum*, *L. Martagon*, lily-of-the-valley, German iris, Spanish iris, Japanese iris, peony, phlox, foxglove, pinks, bleeding heart, delphinium, Japanese anemone, chrysanthemum, funkia, rose mallow and mallow hybrids, candytuft, bluebells, columbine, gaillardia, oriental poppy, hollyhock, platycodon, Shasta daisy, golden glow, baby's breath, small-flowered double sunflower, hybrid pyrethrum, yellow and orange hemerocallis.

Among climbing plants, the best for covering walls in Tennessee are English ivy, Boston ivy, and *Evonymus radicans*; for porches and pergolas, grapes, Virginia creeper, trumpet creeper, Chinese trumpet creeper, Chinese wistaria, Japanese wistaria.

Public-service agencies for horticulture.

The University of Tennessee was established at Knoxville, in 1794, and the College of Agriculture, as a department of the University, accepted the provisions of the first Morrill land-grant in 1868-9. The professorship in horticulture was established in January, 1900. Until 1915 the professor of horticulture also served as horticulturist of the Experiment Station. The Experiment Station is also at Knoxville in connection with the college. To date thirty-three bulletins on horticulture, insects and plant diseases, have been issued by the Experiment Station.

Courses in horticulture are offered in the four normal schools of the state and as a part of the agricultural teaching in the county high-schools. Gardening is taught in many of the city schools.

The Division of Extension of the College of Agriculture has a specialist in horticulture and makes demonstrations in fruit- and truck-growing.

The work of inspecting nurseries is conducted by the State Department of Agriculture. The headquarters of the inspector are at the University.

Statistics (Thirteenth Census).

The approximate land area of Tennessee in 1910 was 26,679,680 acres. The land in farms was 75.1 per cent of the land area, or 20,041,657 acres. Of this land in

farms, the acreage of improved land was 10,890,484; that of woodland 8,007,733; and other unimproved land in farms, 1,143,440. The number of all the farms in 1909 was 246,012, and the average acreage a farm 81.5. [The total area is 42,022 square miles.]

The leading agricultural crops of the state are cereals, cotton (including cotton seed) and hay and forage. The acreage devoted to the production of cereals decreased from 5,055,328 in 1899 to 4,136,617 in 1909, when the production was valued at \$55,302,278, which was 45.8 per cent of the total value of all crops. Cotton, including cotton seed, increased in acreage from 623,137 in 1899 to 787,516 in 1909, when the production was valued at \$20,682,187. Hay and forage increased in acreage from 615,617 in 1899 to 1,052,816 when the production was valued at \$12,617,538. Tobacco increased in acreage from 71,849 in 1899 to 90,468 in 1909, when the production was valued at \$5,661,681. The value of the forest products of the farms in 1909, was \$8,510,710, as compared with \$5,086,624 in 1899.

Horticultural crops produced are fruits and nuts, small-fruits, potatoes and other vegetables, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$3,562,668, as compared with \$1,606,054 in 1899. Small-fruits decreased in acreage from 12,944 in 1899 to 12,539 in 1909 when the production was 13,895,493 quarts, valued at \$923,613. The total acreage of potatoes and other vegetables in 1909 was 167,234, and their value \$10,430,975. Excluding potatoes, the acreage of other vegetables increased from 74,408 in 1899 to 100,055 in 1909, when the value of the production was \$7,015,686. Flowers and plants and nursery products increased in acreage from 2,978 in 1899 to 4,215 in 1909, when the production was valued at \$1,042,282.

The total production of orchard-fruits in 1909 was 6,484,550 bushels, valued at \$3,459,077. Apples contributed nearly three-fourths of this quantity, and peaches and nectarines most of the remainder. The production of apples in 1909 was 4,640,444 bushels, valued at \$2,172,475. The apple trees of bearing age in 1910 numbered 4,838,922; those not of bearing age, 2,117,246. The production of peaches and nectarines in 1909 was 1,579,019 bushels, valued at \$1,055,379. Peach and nectarine trees of bearing age in 1910 numbered 3,163,737; those not of bearing age, 1,190,727. The production of the other orchard-fruits in 1909 was: 139,093 bushels of plums and prunes, valued at \$86,743; 83,557 bushels of pears, valued at \$78,448; 36,303 bushels of cherries, valued at \$60,294; 4,421 bushels of quinces, valued at \$4,045; and 1,677 bushels of apricots, valued at \$1,657.

The production of grapes in 1909 was 1,979,480 pounds, valued at \$85,423. The grape-vines of bearing age in 1910 numbered 338,758; those not of bearing age, 76,010.

The total production of nuts in 1909 was 783,570 pounds, valued at \$14,041. Black walnuts were the most important of the nuts, the production in 1909 being 708,627 pounds, valued at \$9,194. The production of the other nuts in 1909 was: 25,581 pounds of pecans, valued at \$2,566; 16,409 pounds of chestnuts, valued at \$1,127; and 23,246 pounds of hickory-nuts, valued at \$566.

The value of the tropical fruits produced in Tennessee in 1909 was \$4,127. Figs, the most important of the tropical fruits, were produced to the amount of 68,535 pounds, valued at \$4,070.

Of the small-fruits grown in Tennessee, strawberries are the most important, with blackberries and dewberries ranking next. The acreage of strawberries decreased from 11,548 in 1899 to 10,761 in 1909, when the production was 12,339,581 quarts, valued at \$835,739. Blackberries and dewberries increased in acreage from 733 in 1899 to 1,514 in 1909, when the

production was 1,316,100 quarts, valued at \$65,476. Other small-fruits produced were: 222,331 quarts of raspberries, valued at \$20,931; 13,740 quarts of gooseberries, valued at \$1,205; and 3,726 quarts of currants, valued at \$261.

The acreage devoted to the production of potatoes in Tennessee increased from 27,103 in 1899 to 40,963 in 1909, when the production was 2,922,713 bushels, valued at \$1,790,233. Sweet potatoes and yams increased in acreage from 23,374 in 1899 to 26,216 in 1909, when the production was 2,504,490 bushels, valued at \$1,625,056. Peanuts decreased in acreage from 19,534 in 1899 to 18,952 in 1909, when the production was 547,240 bushels, valued at \$386,765. The production of the more important of the other vegetables in 1909 was: 5,803 acres of tomatoes, valued at \$426,714; 2,398 acres of watermelons, valued at \$105,001; 2,300 acres of green beans, valued at \$68,536; 1,189 acres of cabbage, valued at \$64,714; 1,456 acres of cantaloupes and muskmelons, valued at \$41,691; 807 acres of turnips, valued at \$29,553; 235 acres of onions, valued at \$15,068; 139 acres of asparagus, valued at \$13,003; and 365 acres of sweet corn, valued at \$11,216. Vegetables of minor importance in 1909 were beets, popcorn, cucumbers, lettuce, green peppers, rhubarb, and squash.

The acreage devoted to the production of flowers and plants increased from 140 in 1899 to 239 in 1909. The area under glass in 1909 was 1,236,874 square feet, of which 1,079,374 were covered by greenhouses and 157,500 by sashes and frames. The value of the production in 1909 was \$344,579, as compared with \$175,979 in 1899.

The acreage devoted to the production of nursery products increased from 2,838 in 1899 to 3,976 in 1909, when the value of the nursery products was \$697,703, as compared with \$474,133 in 1899.

CHARLES A. KEFFER.

Alabama.

Alabama (Fig. 2518) has many natural features which promise eventually to make it a very important horticultural state. The varied classes of soils, the range in elevations from coastal to semi-mountainous and the different climates between the extreme southern and the extreme northern parts of the state, provide conditions under which many of the fruits of the subtropics and of the temperate zones may be grown very successfully. The average rainfall for the state is 55 inches, most of this falling in the winter months. The average maximum temperature approximates 85° in the summer months and it is seldom that the temperature in the winter falls below 18° F.

Within recent years, hundreds of northern settlers have located in the state and many of these have taken up fruit- and vegetable-growing on an extensive scale; at present the influence of this movement is greater in the more southern counties. Large tracts of freshly cut-over lands are being rapidly developed by different land companies and are being planted principally in pecans and Satsuma oranges.

There are several large greenhouse establishments in the state, the largest of these being at Montgomery. The area of glass is being rapidly increased in Mobile and Birmingham and the smaller cities.

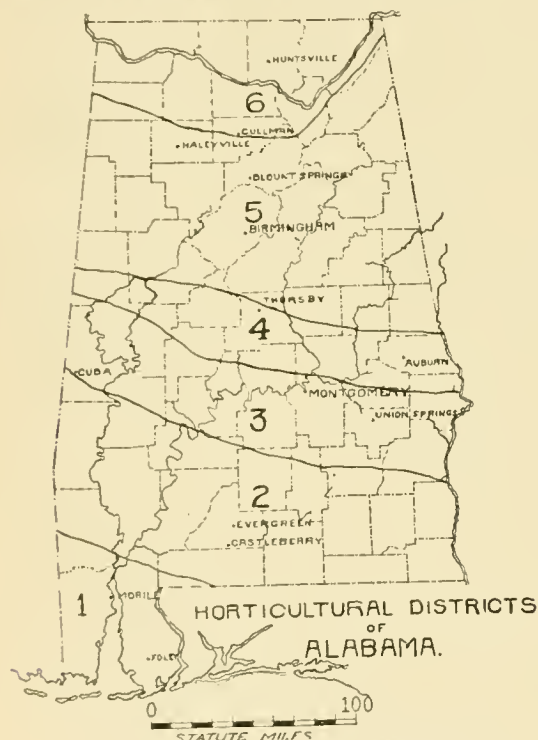
Beautiful out-of-door roses bloom in the spring and fall months and practically every home has its rose-garden. The climate being comparatively warm during ten months of the year furnishes rare opportunities for lovers of flowers.

The principal fruit- and vegetable-growing sections of the state are largely separated, and may be divided into six sections as shown on the map (Fig. 2518).

The light sandy loams of the Gulf section—Lower Coastal Plain (Fig. 2518, Area No. 1)—are particularly

adapted to the growing of early spring vegetables for northern shipment. Mobile cabbage has become popular in the northern market and is, perhaps, grown more extensively in both Baldwin and Mobile counties than any other vegetable crop. In 1910, 714 cars of cabbage were shipped north from Mobile. As a rule, soils upon which cabbage is grown contain very little humus and as a result, considerable quantities of commercial fertilizer are used. The average cabbage-grower, under present conditions, realizes a very small net profit on his cabbage acreage. With scientific management the business should pay. There are many farms on which the percentage of clay is high and when cover-crops are grown on these soils some excellent crops have been produced.

Among other important vegetables grown in the Gulf region are snap beans, cucumbers, English peas, radishes and sweet potatoes, the latter being an important crop. Sweet potato yields average from 200 to 600 bushels an acre, and the average net return is 40 cents a bushel.



2518. Alabama, showing the six leading divisions.

The storage of large quantities of sweet potatoes under the old method is not always successful. The newer method of storage in connection with fire-curing is usually completely successful. At Summerdale in Baldwin County, a canning factory put up 1,000,000 cans in 1911. This industry is receiving considerable attention at present. The Nancy Hall, Dooley, and Early Triumph varieties are commonly grown.

Tomatocles have not been grown on a commercial scale successfully as a rule. "Wilt" and "blossom-end rot" are two diseases that are difficult to control and both are prevalent in the Gulf region. Also the Texas crop is on the market before the Alabama crop and prices are low when the latter comes on.

Watermelons are grown principally for the local market, although many cars are shipped North. They are planted about March 5 in the Gulf region and mature May 1.

Peaches have been successfully grown in the Gulf

region, but there are only one or two commercial peach orchards now being operated. Elsewhere in the state are extensive commercial orchards; one at Atmore embraces 225,000 trees; another at Union Springs contains 1,000 acres. There are also large peach orchards at Blount Springs, Gadsden, and Alexander City. Brown-rot, San José scale, the plum curculio, and the peach tree-borer are the chief pests. San José scale has frequently done great damage before the grower became aware of the nature of the trouble. In this region peaches begin to ripen May 20 and the season extends to August 1 in the northern part of the state.

Japanese persimmons and some of the Japanese plums thrive in the Lower Coastal Plain. The work of the Department of Agriculture and of the Alabama Experiment Station in successfully ripening Japanese persimmons artificially, will give an impetus to the planting of this beautiful and splendid fruit. Persimmons properly ripened are little known outside of the Gulf states. Artificial ripening is chiefly of advantage in shipping the persimmons. They ripen naturally in October and November.

Figs, particularly the domestica group, are grown successfully over most of the state; they are seldom winter-killed and a few old trees will produce from six to ten bushels of fruit, and with the introduction of canning factories this fruit is being more widely exploited. It is difficult to ship the fresh fruit to the North but it has been accomplished successfully. There is a splendid market for the preserved product.

Grapefruit, guavas and so-called "native" sweet oranges are grown successfully in the extreme southern part of Baldwin and Mobile counties, but it is doubtful whether grapefruit will ever be grown on a large scale very successfully. A few ponderosa lemons are also planted about homes. Kumquats offer commercial possibilities and are being planted in a limited way. The fruit makes a delicious marmalade and preserve.

With the introduction of the Satsuma orange, many large nurseries have been established in the vicinity of Mobile, and this promises to be a center for this industry owing to the favorable soils and proximity to the extensive new plantings. Plantings now embrace about 1,500,000 trees, covering 10,000 acres, chiefly in Mobile and Baldwin counties.

The sand pear, although considered by many quite worthless, finds a ready market and is being grown successfully in this coastal section. It is resistant to blight and produces enormous yields.

A few of the early apples, such as Red June, Red Astrachan and Yellow Transparent, can be grown in a small way successfully even as far south as Mobile.

Both the bunch and muscadine grapes do well in the vicinity of Mobile, one instance being known at Flomaton where a grower netted \$600 from one acre of bunch grapes.

In the past few years, there has been an immense increase in the planting of pecans, principally in the territory southward of Montgomery. The varieties in favor are Schley, Stewart, Frottscher, Delmas, Money-maker, President, and others. There are now planted in the state, chiefly in the southern counties, between 250,000 and 300,000 pecan trees. These are grafted trees mostly.

The Upper Coastal Plain (Fig. 2518, Area No. 2) has not been an important section from a horticultural standpoint up to the present. The southwestern section is rapidly developing as a stock-raising region. Pecans are also being planted extensively there. At Evergreen and Castleberry there are large acreages of strawberries, and these towns are famous for the quality of berries they ship North each season. Berries are ready for market from April 1 to 10.

At Evergreen there is a rather novel horticultural industry. Carloads of southern smilax, commonly called "bamboo vine," are gathered in one-mule wagons

by both whites and negroes, and are brought into warehouses and sold to shippers, much as cotton is sold. The smilax is carefully packed into light wooden boxes and shipped to northern cities. The season for shipping this evergreen comes just before Christmas, and holly is also gathered at the same time and shipped North.

In the Black Belt section (Fig. 2518, Area No. 3), a heavier type of soil is found. A few attempts at fruit-growing have been made but none of importance. There are splendid opportunities for small-fruit culture and vegetable-growing. Pecans thrive in this soil. In Sumter County there are many successful truck-growers, and this section ranks second to Mobile as a producer of early vegetables. There is a large fruit-farm in the vicinity of Union Springs in Bullock County where the possibilities of commercial fruit-growing have been demonstrated.

The Central Sandy Region (Fig. 2518, Area No. 4) is not adapted to commercial horticulture, although some excellent peaches are being grown in it. The Experiment Station is located at Auburn in the eastern part of the area. In parts of Lee, Chambers and Tallapoosa counties, fine bunch grapes can be grown.

The Mountain Region (Fig. 2518, Area No. 5) contains such diversified conditions of soil and elevation that it is difficult to describe specific features for the entire region. The counties of Blount, Cullman, Winston and Walker are especially adapted to fruit-growing and there are many large and successful orchards in these counties. On the elevated sites, the danger from frost is eliminated and the strong soils produce firm and beautifully colored fruit. The Elberta peach crop follows the Georgia crop and the market prices are generally good. Many fine apples are also grown, among which might be mentioned the varieties, Black Twig, Champion, Hackworth, Winesap, Shockly, Yates, Black Ben, Ben Davis, Delicious, Grimes Golden, and others. There are successful apple orchards at Ft. Payne and Gadsden. In the vicinity of Cullman, many fine apples are shipped North. The large settlement of Germans at this place has become famous for its successful farms, both general and horticultural. These farmers grow early varieties of sweet potatoes and the town is noted for its production of early strawberries. None of these farmers grows over 5 acres of strawberries, most of them less, but they are well organized and managed and receive maximum net returns. Excellent cantaloupes are shipped from Blount County every season.

The Tennessee Valley Region (Fig. 2518, Area No. 6) is perhaps the most beautiful and most fertile region of the state. At present it is "land poor," in other words, the plantations are too large for successful agricultural operations. The principal horticultural industry in this section is the large wholesale nursery business conducted in and about Huntsville. Owing to the original cheapness of the land and its peculiar adaptability to the growing of nursery stock, 2,500 acres are devoted to this work each year. The fruit-trees which are grown in the order of their importance are: peaches, pears, apples, cherries and plums. More land is now being devoted to ornamental stock than heretofore.

Among the men, no longer living, who have been especially influential in building up horticultural interests, may be mentioned W. F. Heikes. For many years prior to his death, he was in charge of the Huntsville Wholesale Nurseries, one of the largest nurseries in the South. From the time of the organization of the State Horticultural Society, until his death, Mr. Heikes was president of that organization. (See Volume III, page 1578.)

Public-service agencies for horticulture.

The Alabama Polytechnic Institute, which corresponds to the agricultural and mechanical colleges of other states, is located at Auburn. It was established

in 1872. The duties of teaching and experimentation are, in most cases, performed by the same men.

The horticultural staff of the College and Station at present consists of the Professor of Horticulture and Horticulturist; an associate in horticulture, a field agent in horticulture, for experimental work only; and a graduate student assistant in horticulture. The equipment for College and Station consists, aside from the usual classrooms, offices and barns, of storage-rooms and a battery of two greenhouses connected with an extensive workroom, and canning equipment.

Elementary agriculture, which is a required subject in the public schools of Alabama, includes a small amount of work in horticulture. Horticulture is taught as a distinct subject in the ten agricultural schools of secondary grade, and in the state high-schools.

Extension work in horticulture is given in connection with other work at farmers' institutes, movable schools of agriculture and home economics, and in special meetings for the promotion of horticultural interests.

The Horticulturist of the Experiment Station is ex-officio Secretary of the State Board of Horticulture and State Horticulturist. This Board, under the horticultural law amended in September, 1915, is authorized to make quarantine regulations with reference to insects and diseases attacking fruit-trees and other plants.

The State Horticultural Society has been influential in fostering an interest in horticulture. It was founded in 1903. The Gulf Coast Horticultural Society, organized in 1914, a branch of the State Society, is devoted to the citrus interests and questions connected with the specialized horticulture along the Gulf coast of Alabama and similar sections of the neighboring states. A citrus exchange, modeled in a general way after the Florida Citrus Exchange, was organized in 1915 to market coöperatively the citrus and pecan crops. A similar organization to handle truck crops was created shortly afterward. Both organizations have their headquarters in Mobile.

Statistics (Thirteenth Census).

The land area of Alabama, is 32,818,560 acres, of which 63.2 per cent or 20,732,312 acres are in farms. Of this farm area, 46.8 per cent or 9,693,581 acres are improved, 9,444,764 acres are woodland and 1,593,697 acres are classified as other unimproved land in farms. The number of all the farms in 1909 was 262,901, and the average acreage to a farm 78.9. [The total area is 51,998 square miles.]

The leading agricultural crops are cotton, cereals, hay and forage, and forest products. Of these, cotton was the most important in 1909, producing about three-fifths of the total value of crops. The acreage of cotton in 1909 was 3,730,482 as compared with an acreage of 3,202,135 in 1899, showing an increase of 16.5 per cent. The value of cotton products in 1909 was \$87,008,432. The land occupied by cereals in 1909 was 2,844,824 acres. In 1899 the area of cereals was 3,088,454 acres, showing a decrease of 7.9 per cent. The value of the cereal products in 1909 was \$30,927,210. The acreage of hay and forage in 1909 was 238,656 with the products valued at \$3,357,132. In 1899 there were 85,353 acres of hay and forage, showing an increase in the past decade of 179.6 per cent. The value of the forest products in 1909 was \$6,308,151, as compared with \$2,494,452 in 1899, showing an increase of 152.9 per cent in value.

The leading horticultural crops are vegetables, fruits and nuts, flowers and plants and nursery products. In 1909 the total acreage of potatoes and other vegetables was 150,567 and their value \$9,842,784. The acreage of potatoes, sweet potatoes and yams in 1909 was 81,099. Their value in 1909 was \$4,463,207. The acreage in 1899 was 60,370, showing an increase of 34.3 per cent. The acreage of other vegetables also showed an increase of 24.4 per cent during the same period. In

1909 there was an acreage of 69,468, with products valued at \$5,379,577. The acreage in 1899, was 55,822. The value of the fruits and nuts in 1909 was \$2,024,001; in 1899 the value was \$573,763, showing an increase in value of 252.8 per cent. The acreage devoted to flowers, plants and nursery products was 3,199 in 1909 and 1,091 in 1899, an increase in acreage of 193.2 per cent. The value of flowers, plants and nursery products in 1909 was \$127,296.

The total quantity of or hard-fruits produced in 1909 was 2,475,510 bushels, valued at \$1,818,508. Peaches and nectarines contributed considerably more than one-half of this quantity, there being 1,416,584 bushels produced from 3,177,331 trees of bearing age. There were also \$38,866 trees not of bearing age. The number of apple trees of bearing age in 1910 was 1,468,436; those not of bearing age, 737,689. The production in 1909 was 888,396 bushels of apples, valued at \$620,745. The number of pear trees of bearing age in 1910 was 112,300; those not of bearing age, 99,170. The production of pears in 1909 was 100,011 bushels, valued at \$86,866. The production of plums and prunes amounted to 61,712 bushels, valued at \$45,039; that of cherries 3,588 bushels, valued at \$1,873; that of quinces 2,740 bushels, valued at 2,944; that of mulberries 1,527 bushels, valued at \$1,210, and of apricots 952 bushels valued at \$950.

The production of grapes in 1909 amounted to 1,723,490 pounds, valued at \$81,386. In 1910 there were 287,431 vines of bearing age and 77,105 vines not of bearing age.

The leading nuts produced are pecans, black walnuts, and Persian or English walnuts. The number of trees in 1910 were as follows: pecans, 44,683 of bearing age, 125,734 not of bearing age; black walnuts, 3,228 of bearing age, 1,753 not of bearing age; Persian or English walnuts, 3,022 of bearing age, 4,180 not of bearing age. The value of the nut products in 1909 were: pecans, \$30,540; black walnuts, \$3,447; English or Persian walnuts, \$3,557. Almonds were also produced to the value of \$51.

The tropical fruits grown are figs, oranges and pomegranates. In 1910 the number of fig trees of bearing age was 52,731; those not of bearing age, 33,893; orange trees of bearing age, 2,599; not of bearing age, 17,386; pomegranates of bearing age, 1,672; not of bearing age, 3,552. The value of figs in 1909 was \$50,960; of oranges, \$3,663; of pomegranates, \$617. Pomelos (grapefruit) were also produced to the value of \$359.

Of the small-fruits grown in Alabama, strawberries are by far the most important. The production, from 1,167 acres in 1909 was 1,848,537 quarts valued at \$160,026. The acreage in 1899 was 607. The production of blackberries and dewberries in 1909 was 44,594 quarts valued at \$3,726; 10,546 quarts of raspberries and loganberries with a value of \$1,380; 2,452 quarts of gooseberries with a value of \$177. The value of the currants and cranberries grown was \$64 and \$10, respectively.

The leading vegetables, their acreage, and value in 1909 were as follows: green beans, 842 acres, valued at \$62,691; cabbage, 1,366 acres, valued at \$208,754; tomatoes, 566 acres, valued at \$47,322; watermelons, 4,708 acres, valued at \$135,200. Other vegetables grown in Alabama were cantaloupes, muskmelons, sweet corn, cucumbers, onions, green peas, radishes, and turnips.

Alabama ranks fifth in the production of peanuts. The acreage increased from 78,878 in 1899 to 100,609 in 1909, an increase of 27.6 per cent. The production in 1909 was 1,573,796 bushels and their value \$1,490,654.

The area of land under glass in 1909 devoted to flowers and plants was 463,575 square feet, of which 435,400 were covered by greenhouses and 28,175 by

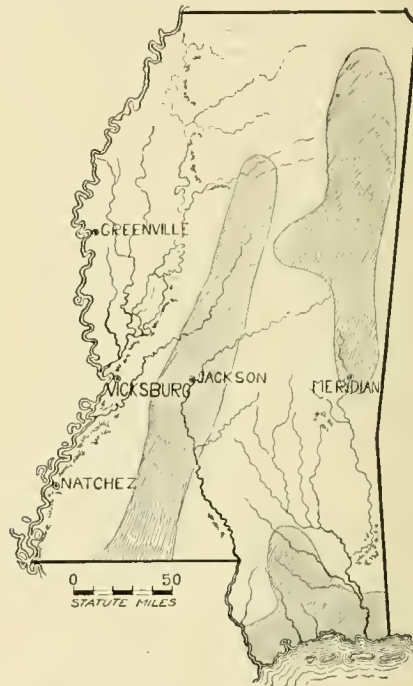
sashes and frames. The value of flower and plant products in 1909 was \$168,239.

The value of the nursery products in 1909 was \$259,057.

P. F. WILLIAMS.
J. F. DUGGAR.

Mississippi.

Mississippi (Fig. 2519) extends about 325 miles from north to south and 175 miles from east to west. The surface is mostly undulating, with few abrupt hills, and the highest part of the state, the northeastern section, is less than 1,000 feet above the sea-level. It has an annual rainfall of about 45 inches in the northern part, the amount increasing to about 60 inches in the extreme south. The winter temperature is rarely as low as zero in any part of the state, while the extreme summer heat rarely reaches 100° in the northern part; near



2519. Mississippi, with the main areas.

the Gulf coast 95° is the usual limit. The first frosts usually occur in November, and spring frosts are rare after the middle of March.

The soil is extremely variable. The western part of the state, known as the Yazoo and Mississippi Delta, has one of the richest alluvial soils in the world, and one well suited for the growing of vegetables, besides cotton and corn, which grow to perfection here. The north-central part of the state consists largely of yellow clay hills, not very fertile and liable to serious injury from erosion, but with very fertile valleys between them, while the northeastern section has a strong lime soil which is very productive. Nearly all of the southern half of the state has a sandy loam soil underlaid with clay at a depth of a few inches, making those lands among the most desirable for the cultivation of either fruits or vegetables.

Although both fruits and vegetables are grown for export in all parts of the state, there are three districts in which horticultural work is specially prominent. These are the northeastern district, covering the territory along the Mobile and Ohio Railroad from Booneville south to Starkville and Meridian; the central district, covering the territory along the Illinois Central Rail-

road from Grenada south to Brookhaven; the Gulf-coast district, covering the territory along the Louisville and Nashville Railroad from Bay St. Louis east to Orange Grove; and along the Gulf and Ship Island road from Gulfport to Hattiesburg.

Peaches are grown more extensively than any other fruit, and are shipped to northern markets from nearly or quite every county in the state. The long growing season enables the trees to come into bearing rapidly, and a small crop of fruit is usually gathered the second year from planting, while the trees often continue fruitful from fifteen to twenty years. Although the trees themselves are never injured by cold, the fruit crop is occasionally cut short by spring frosts following warm winter weather, which sometimes brings the trees into bloom before the end of January. The early fruit is ready for market about the last of May, and shipments continue from that time until August, or later. Elberta, Mountain Rose, Georgia Belle, Lilly Miller and Chinese Cling are among the more popular varieties.

Pears grow well in all parts of the state, and, until about 1895, were planted more widely than any other fruit-trees, but since that time the blight has been so widespread and so severe that very few new orchards have been planted. Fully nine-tenths of the trees are either Le Conte or Kieffer, the latter being the more resistant to blight. In recent years the Sand pear, which does not blight in Mississippi, has been extensively planted and is the most prolific fruiter known.

Apple trees make a fair growth and bear well for some years, but become less vigorous with age, and are short-lived than in more northern latitudes. Nearly all varieties ripen during the summer and fall, and very few, even of the "long keepers," can be preserved through the winter. The fruit always commands a high price in the local markets, which makes the trees profitable, even though they last but a few years. Considerable fruit, mostly Early Harvest and Red June, is shipped from the northeastern district, but no other part of the state produces enough for a home supply.

Plum trees are of uncertain value. The Wild Goose and the Japanese varieties are the more common sorts, and while some trees and some orchards may grow well and bear heavily for many years, most of them succumb after producing two or three crops. Cherries are rarely successful. Figs are grown very commonly for home use in the central part of the state, and in the Gulf coast district are an important market crop. The fig does not succeed under orchard conditions, but a few trees grown near the house do well, and many of the older trees produce 1,000 pounds or more of fruit annually, and this finds a ready market at the canning factories. The Celeste is the common variety, and the demand for the fruit at 4 cents a pound is far in excess of the supply. Oranges are grown along the Gulf coast, but even there the winters are occasionally so cold as to make them unprofitable.

Oranges are being planted extensively along the Gulf coast, especially the Satsuma, a kid-glove variety of Japanese origin, which has proved hardy, producing regular and abundant crops, the trifoliata being used as a stock for grafting. This variety of orange has withstood cold as low as 12° above zero. It is found that it grows and bears equally well, if not better, on the Gulf coast of Mississippi than in its native home. Several million trees of this orange have been planted in the last ten years, and the output has attained to considerable proportions.

Pecans of the paper-shell kind are cultivated extensively throughout the state, especially in the southern tier of counties, Jackson, Harrison and Hancock fronting immediately on the Gulf. Some years ago, some exceedingly large pecans of very thin shell and of a delightful flavor were found growing in Jackson County in the vicinity of Ocean Springs, and Pascagoula in Jackson County. These nuts attracted considerable atten-

tion and many nurserymen on the Gulf coast grafted from these varieties and extensive planting of them was immediately begun. Many large groves are now established on the coast, especially in Jackson County, and the trees bear enormous crops, some of them reaching a capacity of 225 pounds per annum. Grafting-wood from these trees has been taken extensively to other states, in which the soils are adapted to this nut. There are many groves along the Gulf coasts of Mississippi now of 100 to 1,000 acres and the industry promises to be very extensive and profitable to those who engage in it. There was shipped from the Pascagoula district in 1914 more than 200,000 pounds of paper-shell pecans and half as many from the Ocean Springs district.

Grapes grow and bear as well as it is possible for them to do in any part of the country. The long season for growth develops very strong vines which are never injured by the cold of winter, and the latest ripening sorts have ample time for maturing. The early varieties ripen about June 20 in the Gulf coast district, and about July 10 in the northeastern district, and nearly all the crop is gathered by August 1. This early ripening of the fruit enables the grower to secure high prices for his early shipments, but a crop which matures in the heat of midsummer cannot be kept profitably, even in cold storage, but must be marketed at once, regardless of price. Champion, Ives, Delaware, Niagara, Perkins and Herbemont are among the more popular varieties. The Seppernong (*Vitis rotundifolia*) is a valuable native grown in all parts of the state for home use and for the manufacture of wine, but is not a shipping variety.

Among the small-fruits, strawberries are the most important, being grown by thousands of acres. They are grown more extensively in the central district than elsewhere, though there is a considerable acreage in the northeastern district also. In the Gulf coast district the plants grow well and bear abundantly. Klondyke and Lady Thompson are the favorite varieties. Shipments begin about the first of April, and the bulk of the crop is gathered in the next six weeks, though occasional shipments are made in every month of the year.

Blackberries and dewberries grow spontaneously in all parts of the state and have proved profitable in cultivation, the Lucretia, Dallas and other hybrids being the favorite varieties. Neither currants nor gooseberries do well in any part of the state, as they make a new growth and come into bloom soon after the fall rains begin, and soon become so weakened as to be worthless. Raspberries do well when planted on soils containing sufficient moisture, but are seldom grown for market excepting in the northeastern district. Turner is the favorite variety, and the blackcaps are rarely seen.

The growing of early vegetables for northern market is followed more extensively and is more generally profitable than is the growing of fruits. Field plantings of radishes, peas and other hardy sorts begin in January. Shipments begin by the first of March and continue until the melon crop is harvested in July. The first crop of Irish potatoes, mostly Early Ohio and Triumph, is ready for market in May, and in August a second crop is often planted which matures in November, when it finds a ready home market, or is left in the ground until early spring, when it is placed on the northern markets as "new potatoes just received from Bermuda," and brings a high price. The second crop, however, is uncertain, as it is difficult to secure a prompt growth if seed from the early crop is used, and it is often impossible to secure northern seed so late in the season. Sweet potatoes are grown in all parts of the state, and are shipped from July until March. Asparagus is a profitable early crop which is grown largely in the central district, and seems wholly free from rust or other diseases. Rhubarb is unable to endure the heat of the long summer, and the roots soon decay. Beans, beets, cabbages, peas, radishes and turnips are all grown so

largely as to be shipped in earload lots from a number of towns in the northeastern and central districts. The crop grown more widely than any other is the tomato, which is grown in all parts of the state, and which is shipped by the earload to all parts of the country from Boston to St. Paul, Omaha and Denver. Many single growers ship by earlots, and in June from ten to twenty cars are shipped daily from Crystal Springs, which is south of Jackson, with nearly as many from Madison Station and Booneville, besides smaller shipments from many other points. In 1911 more than 1,000 earloads of vegetables were shipped from Crystal Springs, the shipments ranking in importance in the order named, viz., tomatoes, cabbages, beans, carrots, peas, turnips, beets.

From the central district, shipments are made about as follows: Beans, May 10 to June 10; beets, April 20 to June 15; cabbage, May 1 to June 5; carrots, April 20 to June 10; melons (Gem), June 20 to July 20; peaches, June 1 to August 1; peas, March 25 to April 25; potatoes, Irish, May 10 to June 15; radishes, March 1 to April 15; squash, summer, May 15 to June 15; strawberries, April 1 to May 10; turnips, March 20 to May 15; tomatoes, May 25 to July 4; watermelons, July 1 to August 1.

There are a number of canneries in the state, the most successful being those at Booneville and Biloxi, but ordinarily growers find it more profitable to ship products to northern markets than to sell at prices which canners can afford. Partial reports from other points indicate that shipments, in earlots, amount to not less than 8,000 cars annually, in addition to nearly as much more which is shipped in small lots. The northeastern and central districts ship principally to northern markets, while the Gulf coast district finds its markets in Mobile, New Orleans, and on the many foreign vessels loading in Ship Island harbor. Nearly the entire business has been developed in the last twenty-five years, and each succeeding year shows a marked increase in its volume. New localities are being opened, the work is constantly better organized, and, with the increase of the business, the markets are becoming more steady, prices more uniform, and the profits more satisfactory than in the early days. The business has by no means reached its full development, and will not do so for years to come.

Among the men who have been influential in establishing horticultural industries in Mississippi was the late W. R. Stuart, of Ocean Springs, to whom much of the present volume of the pecan interest is due, a development that promises much for the state.

Public-service agencies for horticulture.

The land-grant college of Mississippi was established at Agricultural College in 1880. The institution is near Starkville, in the northern half of the state. At the present time (1915) there are four members of the horticultural staff.

The central Experiment Station is located at Agricultural College and there are three branch stations at Holly Springs, McNeil, and Stoneville. Two of these branch stations are carrying on experimental work in horticulture. Seventeen horticultural bulletins have been issued.

The nurseries of the state are inspected each year by the entomologist of the Experiment Station.

Statistics (Thirteenth Census).

The approximate land area reported in 1910 was 29,671,680 acres, of which 62.5 per cent is in farms. The improved land in farms, numbered 9,008,310 acres; the woodland in farms, 7,883,558 acres; and the other unimproved land in farms numbered 1,665,665 acres. The total number of farms in Mississippi in 1910 was 274,382. The number of acres in the

average farm was 67.6. [The total area of Mississippi is 46,865 square miles, by the latest calculations.]

The leading agricultural crops in Mississippi are cotton (including cotton seed), cereals, hay and forage, and sugar crops, and also forest products of the farm. Cotton is by far the most important of the farm crops. The acreage increased from 2,897,920 in 1899 to 3,400,210 in 1909, when the value of the production was \$96,353,433, or 65.4 per cent of the total value of all crops. Cereals decreased in acreage from 2,372,065 in 1899 to 2,270,503 in 1909, when the value of the products was \$26,864,772. Hay and forage increased in acreage from 99,261 acres in 1899 to 229,705 in 1909, an increase of 131.4 per cent, when the value of the products was \$3,363,647. The value of the products from 42,731 acres devoted to sugar crops amounted to \$1,851,178. The value of forest products of farms in 1909 was \$6,602,943, as compared with \$3,023,626 in 1899. Among crops with no acreage reports, the miscellaneous crops had a value in 1909 of only \$5,740 and in 1899 of \$2,845; seeds had a value of \$1,047 in 1909 and \$1,185 in 1899.

Horticultural crops produced are fruits and nuts, small-fruits, vegetables, including potatoes and sweet potatoes and yams, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$1,579,752, as compared with \$497,779 in 1899. The acreage occupied by small-fruits decreased from 1,549 in 1899 to 836 in 1909, when the production was 1,407,301 quarts, valued at \$107,171. In 1909 the total acreage of potatoes and other vegetables was 125,610 and their value \$9,483,576. Excluding potatoes and sweet potatoes and yams, the acreage of vegetables was 61,223 and their value \$5,868,275. Flowers and plants and nursery products increased in acreage from 243 in 1899 to 572 in 1909, when the value of the production was \$175,267, as against \$58,212 in the year 1899.

The production of orchard-fruits in 1909 was 1,634,305 bushels, an increase of 167.5 per cent over 1899. Peaches and nectarines, and apples produced most of this quantity. The number of peach and nectarine trees of bearing age in 1910 was 1,726,298; those not of bearing age, 724,895. The production in 1909 was 1,156,817 bushels, valued at \$925,288. The number of apple trees of bearing age in 1910 was 427,652; those not of bearing age, 425,323. The production in 1909 was 265,841 bushels, valued at \$213,714. Pears and plums and prunes were of relative importance in 1909, there being produced 101,288 bushels of pears, valued at \$96,777, and 101,974 bushels of plums and prunes, valued at \$79,971. There were also produced in Mississippi, in 1909: 2,819 bushels of cherries, valued at \$3,749; 2,277 bushels of apricots, valued at \$2,510; 2,725 bushels of quinces, valued at \$2,863; and 564 bushels of mulberries valued at \$634.

The grape-vines of bearing age in 1910 numbered 77,012; those not of bearing age, 34,870. The production decreased from 1,070,625 pounds in 1899 to 760,563 pounds in 1909, when it was valued at \$44,262.

The total production of nuts in 1909 was 866,504 pounds, valued at \$90,885. Pecans are by far the most important of the nuts, producing in 1909, 637,293 pounds, valued at \$79,936. In addition, 66,492 pounds of Persian or English walnuts were produced, valued at \$6,949, and 151,406 pounds of black walnuts, valued at \$3,700.

Tropical fruits were produced in 1909 to the value of \$119,129. Figs are the most important, there being produced in 1909, 1,949,301 pounds of figs, valued at \$107,609. Oranges are apparently increasing since the number of orange trees of bearing age in 1910 was 10,452, and those not of bearing age, 38,637. The production of oranges in 1909 was 3,779 boxes, valued at

\$8,684. The number of grapefruit (pomelo) trees of bearing age in 1910 was 1,001; those not of bearing age 1,978. The production in 1909 was 1,368 boxes, valued at \$2,345.

Strawberries are by far the most important of the small-fruits in Mississippi, although the total acreage of all small-fruits decreased from 1,549 in 1899 to 836 in 1909. Considering strawberries, the acreage decreased from 1,383 in 1899 to 772 in 1909, when the production was 1,345,013 quarts, valued at \$101,882. The other small-fruits produced were: 53,735 quarts of blackberries and dewberries, valued at \$4,531; 7,806 quarts of raspberries and loganberries, valued at \$673, and minor quantities of currants and gooseberries.

The acreage of sweet potatoes and yams increased from 38,169 in 1899 to 56,045 in 1909, when the production was 4,427,988 bushels, valued at \$3,073,290. The acreage devoted to the production of peanuts increased from 5,853 in 1899 to 13,997 in 1909, an increase of 139.1 per cent. The production in 1909 was 284,791 bushels, valued at \$317,236. The acreage devoted to potatoes increased from 6,370 in 1899 to 8,342 in 1909, when the production was 644,742 bushels, valued at \$542,011. Of the other vegetables grown in Mississippi, the more important were: 3,651 acres of tomatoes, valued at 401,984; 1,396 acres of cabbage, valued at \$98,244; 1,794 acres of watermelons, valued at \$86,973; 1,052 acres of green beans, valued at \$43,925; 194 acres of radishes, valued at \$30,216; 435 acres of green peas, valued at \$18,342; and 234 acres of turnips, valued at \$15,987. Vegetables of minor importance were asparagus, beets, cantaloupes and muskmelons, carrots, sweet corn, cucumbers, lettuce and onions.

The acreage devoted to the production of flowers and plants decreased from 62 in 1899 to 39 in 1909. The total area under glass in 1909 was 216,937 square feet, of which 201,622 were covered by greenhouses and 15,315 by sashes and frames. The value of the flowers and plants produced in 1909 was \$100,321.

There was a marked increase in the acreage devoted to nursery products—from 181 in 1899 to 533 in 1909, an increase of 194.5 per cent. The value of the nursery products in 1909 was \$74,946, as compared with \$31,305 in 1899.

S. M. TRACY.
F. H. LEWIS.

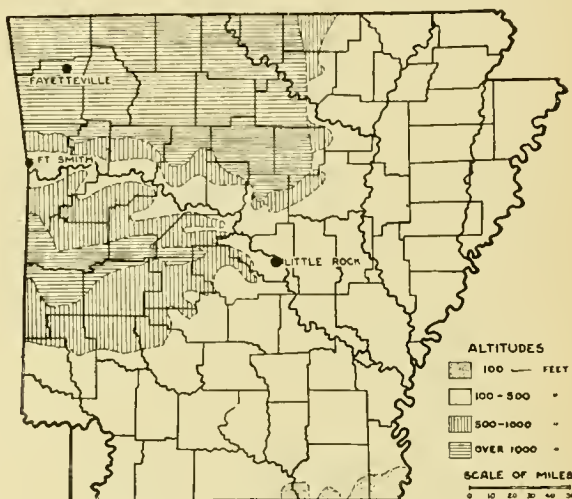
WEST SOUTH CENTRAL STATES.

Arkansas.

Differences in altitude give the state of Arkansas (Fig. 2520) two general types of climate and agriculture. The northwestern two-fifths of the state has a north-temperate climate and is adapted to practically all the crops usually grown some hundreds of miles northward. In the southeastern three-fifths of the state, climatic conditions are subtropical, cotton being the leading farm crop, while corn and rice are also grown extensively. A line drawn from the northern part of Sevier County to Arkadelphia, thence past Little Rock, a little to the northward, and thence to Mammoth Springs in northern Arkansas separates in a general way the two divisions. The division line represents a general elevation of 500 feet. Northwestward the general elevation soon increases to 1,000 feet, with here and there points and ridges rising a few hundred feet higher. The Boston Mountain, a ridge running eastward along the southern border of Washington County and extending into Searey County, presents an elevation of about 2,000 feet. This barrier has a marked effect on the climate north of it, making the conditions like those of regions many miles farther north. Southward the slopes descend into the Arkansas Valley and into a truly southern climate. Between Fayetteville and Van Buren, a distance of about 60 miles, there is a difference of ten to twelve days in the earliness of the season. In Pope County, Mount Magazine (height, 2,850 feet) is said to

be the highest point between the Alleghany and Rocky Mountains. The Ozarks of northwestern Arkansas enter the state from Oklahoma and Missouri. In central-western Arkansas, the broken elevated area consisting of a series of ridges running in an easterly and westerly direction is known as the Ouachita Mountains. In general, the main hills or ridges and valleys in the hill country of Arkansas have an easterly and westerly direction. They represent the work of erosion, although the Ozark region as a whole is part of an uplift and one of the oldest parts of the continent.

The surface in general of the highland is rolling, partly tableland, rough in places with small prairies



2520. Arkansas, to show horticultural parts.

here and there. The average elevation of the Ozark portion of the state is about 1,000 feet above sea-level. Some of the valleys are narrow, others broad, miles in extent and of great fertility. On some of the hills the soil is thin and poor, sometimes very rocky; again it is fertile and deep. North slopes, as a rule, are more fertile than the southern. There are various types of soil from sandy to clayey loam, cherty soils and the rich brown loam known as "pawpaw" soil with redclay subsoil overlying limestone. Clarksville silt loam and Clarksville stony loam are common types of upland soil in northwestern Arkansas. The valleys also range from sandy alluvial loam to clayey and heavy black soils very rich but sometimes needing drainage. In their natural condition the hills and valleys are covered with the various kinds of forest growth characteristic of the northern woods, contributing to the mildness and healthfulness of the climate.

The winters are short and summers long. The mean temperatures for January and July, respectively, at Fayetteville are 37.59° and 77.03°, and at Little Rock, 40.8° and 80.3°. The rainfall is ample and ordinarily well distributed throughout the year. The average for the state is 50.5 inches. It is somewhat less in northwest Arkansas, being 45.6 at Fayetteville and reaching 63.2 inches at Hot Springs. Irrigation is not necessary. Proper tillage may be made to conserve the supplies of moisture sufficiently for bountiful yields under all ordinary conditions. The average snowfall in the hill country is nine inches; southward it varies from three to five.

The southeastern half of the state is in reality a part of the low level and fertile Atlantic coastal plain and is similar to Louisiana. The surface is rolling, varying from 100 to 500 feet in elevation. Much of the land, especially along the Mississippi, is low-lying and sub-

jeet to inundation from the Mississippi River. In this part of the state are numerous lakes, bayous and swamps. There are about 6,000,000 acres of these lower-lying lands, of abounding fertility, needing only drainage to make them among the most productive in the world. Along the lower valley of the Arkansas the soil grades into black sandy and "buck-shot," the richest soils of the state. Along the southern border of the Ozarks and Ouachita elevations is a belt which, while belonging to the highland area, represents an intermediate zone between that and the lowland country of the state. It is especially adapted to growing peaches.

In the lower parts of the state there are also locations affording air-drainage and soils suited to commercial peach-growing. On the whole, however, this region will be found best adapted to truck-farming. Some crops, like onions, spinach, and kale, may be planted here in the fall months. Figs, Japanese persimmons, pecans, and some varieties of grapes offer good opportunities, while selected varieties of most north-temperate fruits may be grown successfully for home use.

The principal horticultural industry is the production of winter apples. The leading counties are Benton, Washington and Madison in northwest Arkansas. Transportation facilities have been an important factor in stimulating development. Other counties in the Ozarks equally good for fruit lack railroad transportation and for this reason are less developed horticulturally. Quantities of second-grade apples go to driers or are converted into vinegar. Some fifty-six varieties of apples have originated in Arkansas, some of them being of great commercial value, not only in this state, but elsewhere. A recently introduced variety is the King David which originated in 1903 near Durham, Washington County. Formerly about 95 per cent of plantings were Ben Davis. More recently there has been a noticeable tendency to plant varieties of better quality. Leading winter varieties of apples at present are Ben Davis, Gano, Black Ben, Winesap, Jonathan, Arkansas, York Imperial, Grimes Golden, Ingram, Givens, Collins, Beach, Stayman's Winesap, Delicious and King David.

For the past several years, increased attention has been given summer apples. These are grown with success southward as well as in the hill country. Leading varieties are Maiden's Blush, Duchess, Horse, Buckingham, Summer Champion, Red June, Red Astrachan and Yellow Transparent. While an excellent market variety, the last is very subject to "twig-blight," especially in the lower part of the state.

Second only to the apple-orchard interests is the commercial production of peaches. To S. B. Wing and his brother belong the credit of having shipped the first carload of Elberta peaches out of Arkansas. Thus began the commercial peach industry which has assumed such vast proportions in the state in the past ten years. The Elberta is not so reliable in the higher districts as in some of the counties lying along the southern slopes of the Ozarks and Ouachita Mountains. Here the air-drainage, soil and other conditions are such as to be especially favorable for almost annual crops and peaches of splendid color and quality. The record in Crawford County is about seven crops in ten years. In 1911, orchards in Pike and Sevier counties were practically the only peach orchards in the United States which produced crops. The fruit from these orchards brought probably the highest prices on record for peaches in carlots. The two first cars shipped to New York brought \$2,080 a car, and later averaged \$1,500 a car. Extensive peach-orchard interests have in recent years developed rapidly in Pike County. Commercial plantings are chiefly Elbertas. The shipping season follows that of Texas and Georgia when the markets are slack, which proves to be a great advantage. Very early peaches for shipment have not proved profitable. Northwest Arkansas will have to find a variety hardier in bud than Elberta.

Champion, Carman, Slappy, Belle of Georgia, Madison County Mammoth, General Lee, Crosby, and possibly some others are much more reliable varieties for northwest Arkansas, although not so satisfactory for shipment as the Elberta.

Pears are not receiving much attention on account of their susceptibility to "fire blight." Kieffer, Garber, LeConte, Winter pear (Sand pear), Seckel and Duchess are among the varieties least susceptible to blight.

Cherries are of comparatively little commercial importance at present. The sour cherries are the most satisfactory. There are but few large cherry orchards in the Ozark region. Leading varieties are English Morello, Early Richmond, Montmorency and May Duke.

Plums were represented in 1909 by 731,276 bearing trees. Leading varieties are Burlbank, Red June, Gold, Wild Goose, Poole's Pride, Damson, German Prune.

Pecan trees are found growing wild in abundance in the cotton section of the state, especially in river-bottoms. The interest in pecans has rapidly increased in the past three or four years. Some recent single plantings contain as high as 400 acres of grafted trees. Some pecans are being grafted on the common hickory. Such trees are known to thrive and bear as well as on their own roots. The Schley and Moneymaker are known to do well in the state.

English walnuts are receiving practically no attention. How well they would succeed remains to be determined. The black walnut and hickories are common growing wild and occasionally large sweet chestnut trees are found, although the chinquapin is much more frequent. Some attempts have been made to use the latter as a stock for the sweet chestnut with good success, especially in the case of the large Japan chestnut.

Grapes thrive in Arkansas. The output of vineyards at present is used chiefly for wine. The Cynthiana, a variety of native origin, is the most highly valued wine-grape. Saline County some years ago was an important grape- and wine-producing county, the industry being conducted chiefly by German citizens. Owing to state laws against the sale of alcoholic drinks, the industry declined. At present the law allows the producer to sell native wine in quantities of not less than five gallons, not to be consumed at the place where sold, nor sold in the localities having the "five-mile" law or local prohibition. The bottling of unfermented grape-juice offers excellent opportunities. Grapes receive special attention at Tontitown, Altus, Silver Springs, Highland and other points. In the past few years extensive plantings have been made at some points southward. Joseph Bachman, of Altus, has been the originator of several varieties of great merit (Sunrise, Banner, Stark's Star and others).

Strawberries have been commercially grown in a large way for many years in northwest Arkansas, as well as in counties southward. George P. Murrell, of Austin, shipped the first crate of strawberries to St. Louis some forty years ago. Mr. Bauer, of Judsonia, was also one of the pioneer growers. About 1893, C. H. Gregory commenced the strawberry industry in Crawford County, and it has extended northward along the Frisco and Kansas City Southern Railroads in northwest Arkansas and has become one of the most important branches of fruit-growing in the Ozarks. Leading varieties at present are Excelsior, Klondyke and Aroma.

Blackberries are canned extensively and grown throughout the state for home use. While shipped to some extent, they are not important as a commercial crop. Currants seem not to thrive. Of gooseberries, Smith and Houghton only prove satisfactory, and these only in the mountain region.

In the west where irrigation is necessary, orchards are planted in the valleys. In the Ozarks where the rainfall is ample for the needs of crops, apple and other

fruit trees are planted mainly on the slopes and higher lands where, owing to air-drainage, the fruit is less subject to damage by spring frosts than in the valleys. Although there is a critical frost period the latter part of April, properly located and cared-for orchards escape injury except occasionally. A typical Ozark orchard of 40 acres under good care has borne during the past seventeen years fourteen good crops of apples, two light crops, and has had but one total failure. Another apple orchard has had in seven years six fair to large crops and but one very light crop. Experiments indicate that orchard-heaters are not necessary in well-located and well-cared-for apple orchards in the Arkansas Ozarks except occasionally, or at intervals of four or five years. Like spraying, it is a kind of insurance and some growers have provided heaters for a part of their orchards as a safeguard against the occasional frost-damage. The higher parts of the state are not so well suited to the Elberta peach as lands southward on the southern slopes of the highlands where the elevation ranges from 300 to about 800 feet. In both sections peaches are damaged more frequently by winter injury to the flower-buds than by spring frosts. Orchard-heaters are practical and successful in raising the temperature in the orchard sufficiently, under usual conditions, to save the crop, but careful attention to location, air-drainage, and proper care are more important.

Many of the fruit and other trees planted are purchased from nurseries outside the state, and planters have suffered frequent loss from trees proving untrue to name, infested with San José scale and diseased by crown-gall. In 1911 only twenty nurseries in the state called for official inspection. The growing of ornamentals is represented in the state by a few nurseries only. There is an extensive greenhouse establishment at Little Rock and several smaller establishments which at other points supply the local demand. The forcing of flowers and vegetables under glass receives but little attention and only for the supply of local trade at a few of the large towns.

Tomatoes are grown extensively throughout the state; string beans also, for shipment and canning. Asparagus thrives throughout the state. Onions have not received much attention commercially, probably because Texas has the advantage in earliness and produces such large quantities. Rhubarb is grown and shipped to a limited extent in northwest Arkansas. It does not succeed southward. Melons are an important commercial crop. Both the watermelons and cantaloupes grown are of high quality. Many hundreds of carloads are shipped northward in their season, from a few shipping-points. The Arkansas Gems reach the markets some weeks in advance of the well-known Colorado melons. Watermelons evidently were introduced into the state at a very early day, since it is said that the Indians treated to watermelons the remnants of La Salle's band when they were passing through the state in 1687.

Irish potatoes are grown extensively throughout the state. Red Bliss is the leading variety grown. Early Ohio, Irish Cobbler, Sunlight and Burbank are also grown. In 1909, counties leading in production were: Sebastian, 101,328 bushels; White, 91,231 bushels; Washington, 67,739 bushels; Pulaski, 62,253 bushels; and Crawford, 46,492 bushels.

Sweet potatoes find congenial conditions in all parts of the state and yield well under fair treatment, yields ranging from 200 to 600 bushels an acre.

Many of the orchard-owners have evaporators for utilizing the second-grade apples. Towns in the several orchard districts have one to several evaporating plants of large capacity which make a business of producing evaporated apples. Culls, cores and peelings are converted into vinegar.

Before the National Pure Food Law was passed (1906), little cider vinegar was produced in a commercial way. At present there are large and well-equipped

plants at Rogers, Siloam Springs and other points. There are also large apple-brandy distilleries at Rogers and Bentonville, the latter being the largest in the world.

Home canners have become common in connection with fruit-growing and truck-gardening in order to utilize surplus fruit for home use and local markets. There are large well-equipped central plants at Prairie Grove, Bentonville, Fayetteville, Decatur and some other points.

Public-service agencies for horticulture.

Horticultural instruction is given as a part of the Agricultural College work at the State University at Fayetteville. It is also provided for in each of the four Agricultural High Schools by legislative enactment in 1907, and opened for instruction two years later. These schools are located at Russellville, Jonesboro, Monticello, and Magnolia. Extension work is carried on by the college.

There are local horticultural societies at a number of points where such interests are important or being developed. Springdale and Bentonville have very successful societies. The latter has been in existence for many years, and is well known beyond the confines of the state for its useful work.

Coöperative fruit-marketing associations exist at most of the important shipping-points. These, when independent, compete with each other more or less by shipping to the same markets. The Ozark Fruit-Growers' Association is a general organization formed in 1904 to handle the output of the numerous local associations of the Ozark region.

The Arkansas State Horticultural Society was organized in 1879. Among the original organizers, S. H. Nowlin, W. S. Thomas, E. F. Babcock, Jos. W. Vestal, W. K. Tipton have all rendered valuable services to horticulture. Judge I. B. Lawton, for years secretary of the Benton County Horticultural Society, also deserves special mention. Recently the fruit-growers of northwest Arkansas have organized "The Northwest Arkansas Fruit Growers' Society," as a branch of the State Society. The sweet potato growers have also organized a society as a branch of the State Society.

Statistics (Thirteenth Census).

The approximate land area is 33,616,000 acres of which 51.8 per cent, or 17,416,075 acres, are in farms. The percentage of the farm land that is improved is 46.4, or 8,076,254 acres. The farm land in woodland is 8,511,510 acres, and the unimproved land in farms numbers 828,311 acres. There are 214,678 farms in the state, the average size of which is 81.1 acres. [The total area of Arkansas is 53,335 square miles.]

The leading agricultural crops are cereals, hay and forage, cotton, and forest products. In 1909 the value of the cereals was \$31,262,922. The acreage was 2,564,898 in 1909, a decrease of 13.9 per cent since 1899, when it was 2,980,684. The acreage of hay and forage, in 1909, was 435,915, an increase of 82.1 per cent over the acreage in 1899, when it was 229,426. The value of the hay and forage products in 1909 was \$4,887,139. In 1909 cotton contributed 52.9 per cent of the total value of all crops. The value of cotton products in 1909 was \$63,155,683. The acreage of cotton in 1909 was 2,153,222, as compared with 1,641,855 in 1899, an increase of 31.1 per cent. The value of the forest products in Arkansas for 1909 was \$6,914,262.

The leading horticultural crops are fruit, vegetables, small-fruits, nuts, flowers, plants and nursery products. In 1909 the value of the fruits and nuts was \$3,142,891; of vegetables, \$7,641,102; of small-fruits, \$601,722; and of flowers, plants and nursery products \$352,000.

The principal orchard-fruits are apples and peaches, which in 1909 produced more than one-half of the

total quantity of orchard-fruits. The number of apple trees of bearing age in 1910 was 7,650,103; the apple trees not of bearing age numbered 3,940,089. The quantity produced in 1909 was 2,296,043 bushels, valued at \$1,322,785. The peach trees that were of bearing age in 1910 numbered 6,859,962; those not of bearing age, 2,881,927. The production of peaches was 1,901,647 bushels, valued at \$1,502,996. The production of the other orchard fruits and their value in 1909 is as follows: pears, 37,517 bushels, valued at \$38,140; plums and prunes, 194,619 bushels, valued at \$137,003; cherries, 5,993 bushels, valued at \$8,424; apricots, 1,067 bushels, valued at \$1,091; quinces, 680 bushels, valued at \$751.

Of nuts the pecans and black walnuts were the most prominent, there being 249,955 pounds of pecans produced in 1909, valued at \$17,603; and 514,273 pounds of black walnuts, valued at \$7,795. In 1910, the number of pecan trees was 13,958, while the number of black walnut trees was 9,104. In addition to the pecans and black walnuts, Arkansas produced, in 1909, 15,436 pounds of Persian or English walnuts, valued at \$1,384, and 3,330 pounds of almonds, valued at \$622. The only tropical fruit of any significance is the fig, of which \$0,707 pounds were produced in 1909, valued at \$5,933.

The production of grapes in 1909 amounted to 2,593,727 pounds, valued at \$97,985, a decrease from 3,621,100 pounds, valued at \$101,803 in 1899.

Of the small-fruits, strawberries are by far the most important, with blackberries and dewberries ranking next. The total acreage of small-fruits in 1909 was 8,032; and in 1899, 10,819, a decrease of 25.8 per cent. The production in 1909 was 8,965,572 quarts, as compared with 14,098,000 quarts in 1899. The acreage of strawberries in 1909, was 7,361, producing 8,259,240 quarts, valued at \$549,041. The acreage of blackberries and dewberries was 525; the production 587,977 quarts, valued at \$40,843. The production of other small-fruits in 1909 are as follows: 96,414 quarts of raspberries, valued at \$9,766; 18,168 quarts of gooseberries, valued at \$1,630; 3,201 quarts of currants valued at \$390; and 288 quarts of cranberries, valued at \$26.

In 1909 the total acreage of potatoes and other vegetables was 112,358 and their value \$7,643,102. The production from 29,719 acres of potatoes in 1909 was 2,096,893 bushels, valued at \$1,439,991. The production from 22,388 acres of sweet potatoes and yams for the same year numbered 1,685,308 bushels, valued at 1,359,669. Other vegetables, excluding potatoes, sweet potatoes and yams, occupied an area of 60,251 acres in 1909, compared with 45,355 acres in 1899, and the value of their products was \$4,843,442 in 1909, as compared with \$2,215,587 in 1899. The more important of these vegetables in order of value are watermelons, cantaloupes and muskmelons, tomatoes, turnips, cabbage and onions.

The value of the flowers and plants in 1909 was \$153,421. The area under glass, devoted to this industry, was 235,134 square feet, of which 224,150 square feet were covered by greenhouses and 10,984 square feet by sashes and frames. The increase in the value of the flowers and plants was 494 per cent, from 1899 to 1909.

The nursery products, in the period from 1899 to 1909 decreased 39.2 per cent in acreage but increased 51.5 per cent in value. The acreage in 1909 was 528; in 1899, 868. The value of the nursery products was \$198,579 in 1909, and \$131,015 in 1899.

ERNEST WALKER.

Louisiana.

Louisiana (Fig. 2521) is situated at the extreme lower limit of the great Mississippi system, bordering on the Gulf of Mexico. These bodies of water have an impor-

tant bearing upon the climate, and make it possible to grow some of the subtropical fruits. The prevailing wind is from the south, somewhat cool and always laden with moisture, and the southern part of the state, being only about 30 feet above the sea-level, receives the heaviest rainfall, 70 inches, while the northern part which is more elevated and farther from the Gulf, has an annual rainfall of 45 to 50 inches. This, as a rule, is well distributed throughout the state, the seasons of greatest drought being early spring and early autumn.

The highest recorded summer temperatures run from 98° along the Gulf coast, to 102° in the northern part of the state, while the average winter temperature is 56°.

Occasionally a northwestern blizzard reaches down into the state, causing a heavy fall in temperature, accompanied with sleet, and once in a long time, snow. The lowest recorded temperature on this account was 9° in 1895, and 13 inches of snow. This was an occurrence unheard of by the oldest inhabitants. These occasional blizzards have forced the culture of tropical fruit down to the section immediately bordering on the Gulf. As the soil has such an important bearing upon the character of the fruit, a rough classification of the different kinds is here given.

1. The sandy hills and uplands occupy the northwestern part of the state along with a section in the eastern part, south of the state of Mississippi, constituting about one-half the total area of the state. The lands are characterized by sandy soils, with pine and oak forests, and produce the best stone-fruits and berries.

2. The bluff lands occupy a broken strip, running parallel with the Mississippi, from 30 to 50 miles from its western bank, and disappear near the Gulf in what are known as "islands," such as "Avery's Island" and "Jefferson's Island." There is also another section of these lands on the east bank of the river immediately south of the Mississippi state line. These lands are characterized by a yellow clay loam, very fertile, and by forests of magnolias, gums, oaks, and the like. They produce some of the stone-fruits well, and an abundance of pecans, berries and figs.

3. The prairie lands occupy a part in the central southwestern part of the state, are treeless, low and are also known as rice lands. The soil is poor but improves with cultivation, and gradually the planting of figs, pears, peaches, plums and grapes have been extended.

4. The alluvial lands make up all the other parts of the state not mentioned, including the river-bottoms. The soil is generally dark, ranging from black to light red, very fertile and abounding in an abundant growth of timber. They produce the heavy yields of cotton and corn in the northern part, and the sugar-cane, oranges, lemons, persimmons, figs and bananas, as well as other tropical fruits, in the southern part.

5. The pine flats are found in the western and extreme eastern parts of the state where the hill lands merge into an extended area of level lands which in turn are gradually depressed to the Gulf marshes. This area is naturally wooded with dense forests of long-leaf pine. The soil is not very fertile, but when properly drained and fertilized becomes an excellent soil for strawberries and some small-fruits. Trucking is also highly developed in some parts of the pine flats.

The leading varieties of vegetables are grown in every section of the state, and the home garden furnishes an abundant supply during all seasons of the year, under proper management. Those vegetables most popularly grown for home consumption are as follows: Asparagus (on the sandy soils only), artichokes (both Globe and Jerusalem), beans, beets, cabbage, carrots, collards, corn, cress, cucumbers, casha (pumpkin), endive, egg-plants, kohlrabi, leek, lettuce, melons, mustard, okra, onions, parsley, peas, peppers, Irish potatoes (two crops), sweet potatoes, radishes, spinach, tomatoes, turnips and rutabagas. Occasionally there is found the vegetable pear (*Sechium edule*), martynia, brussels

sprouts, celery, chervil, garlic, kale, salsify, parsnips, cauliflower, and field pumpkins. Most of these vegetables may be sown several times during the year. Celery and cauliflower, however, are sown early in August in order to mature by the Christmastide.

The commercial truck sections are found in various sections of the state. Along the Illinois Central Railroad a direct line to Chicago from New Orleans, which runs through the warm sandy pine lands, the most extensive truck-farms are to be seen. The vegetables grown are radishes, carrots, beans, cabbage, Irish potatoes, tomatoes, peppers, eggplants, and cauliflower. Hundreds of carloads of these vegetables are sent to the north, northern, and eastern markets during the months of March, April, and May. This section is also one of the largest producing areas of strawberries in the United States. Tangipahoa Parish alone has over 15,000 acres and ships 1,200 to 1,500 or more cars annually. The Klondyke is the variety universally planted. It is a wonderful shipper and is found on the market as far east as Boston, as far north as Canada, and even as far west as Seattle. The value of this crop alone runs into millions of dollars.

On the same railroad, a little above New Orleans, is Kenner, which is noted in the North for its "bunch crops," such as shallots, carrots, beets, turnips, radishes, mustard and spinach. The rich alluvial lands of this section produce these crops to perfection. They are packed in sugar barrels with crushed ice. Quotations on Kenner vegetables are usually above the average on account of their excellent quality and solid pack. Cabbage, lettuce, and snap beans are also extensively grown and shipped from this point.

The largest truck section of the state is found in the vicinity of New Orleans. This city is also the distributing point for large quantities of vegetables grown along the river and bayous southward. Thousands of cars move over the many trunk lines to the North, East, and West. Shallots, turnips, beets, radishes, carrots, mustard, and spinach are extensively grown and shipped in sugar barrels; also lettuce, endive, cabbages, cucumbers, eggplants, peppers, beans, and many other vegetables adapted to the alluvial soils. In this section are found the large commercial orange groves of the state. (See *Orange-culture in Louisiana*, p. 2374.)

Along Bayou Lafourche from Donaldsonville to Lockport, Creole onions are extensively grown as well as Irish potatoes. This section is beginning to plant large quantities of Snowball cauliflower.

Alexandria is the center of the Irish potato industry. Trainloads of early potatoes from this point move northward during late April and early May.

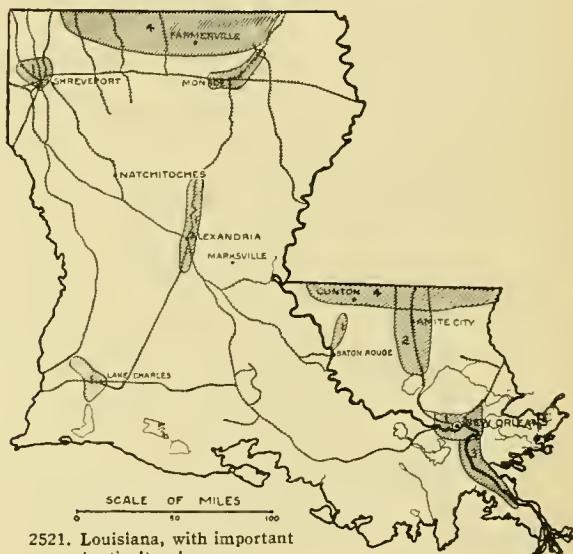
Early tomatoes are extensively planted at Norwood along the Yazoo & Mississippi Valley Railroad. The warm rolling sandy loams of this section produce a very early fruit of high quality. A very successful coöperative canning factory is being operated to utilize surplus vegetables that cannot be shipped. Hundreds of acres of Cayenne peppers are grown in this vicinity and the product is dried and ground by a local factory.

The varieties of these vegetables grown for the northern markets are as follows: The Aeme and Beauty tomatoes, the Chartier radish, the New Orleans Market eggplant, the Peerless and Triumph Irish potatoes, the New Orleans Market and White Spine cucumbers, the Drumheads, Flat Dutch, Succession, All-Seasons and Nonesuch cabbages, the Italian and Bermuda type of onions, the First-and-Best and Alaska peas, the Early Mohawk and Valentine beans. In the northern part of the state large quantities of Irish potatoes are grown, and oftentimes the second crop is very profitable. The first crop is planted in January or February and harvested in May and June. The seed for the second crop is prepared for planting by special treatment, consisting of gradually exposing the tubers to the light and moisture, which matures them and excites the eyes

into growth. As soon as this is accomplished they are ready for planting, which is usually during August. They are harvested in November.

Upwards of 5,000,000 bushels of sweet potatoes are grown annually, the varieties best known being Pumpkin, Nancy Hall, Triumph, Creole, California, Bermuda, Red and Yellow Nansemond, Hayman, Providence, Yellow Jersey, Southern Queen and Vineless. The last variety is one of the most desirable of the newer sweet potatoes.

The culture of fruit, other than oranges and strawberries, has been neglected in great measure. Apples do fairly well only in the northern part of the state, the desirable varieties being Smith, Horse, Red June, Mangum, Early Harvest, Cullasaga and Shannon. Grapes are grown but sparingly, as the long, warm, moist sea-



son offers the best conditions under which the grape diseases develop, and the daily rains hinder the use of fungicides; however, in the northern and southwestern parts of the state the following varieties have been found desirable: Champion, Diamond, Eaton, Niagara, Concord, Delaware, Brighton, Sweet Mountain, Heribemont and Jacques. Only the Chinese type of pears is at all grown, as it offers more resistance to the blight than the others. The desirable varieties are LeConte, Kieffer, Smith, Garber, Dai Dai, Golden Russet and Mme. Von Siebold. The European varieties of plums do not succeed, but many of the American and Japanese sorts do well. The desirable varieties are Burbank, Abundance, Satsuma, Kelsey, Chabot, Wild Goose, Robinson and a few others. The fig is grown universally in all sections of the state, the best varieties being Celeste, Brunswick, White Ischia, Magnolia, Angelique, Lemon, Mission and Reine Blanche. The Japan persimmons are being set extensively, using chiefly the Hyakume, Kurokume, Nero Zami, Hachiya, Tsuru and Among. These fruits are large, showy, and will stand transportation well. The Elberta, Sneed, Peen-to (in the south) and Chinese Cling peaches prevail.

The other fruits, grown in a limited way, are quinces, gouni, blackberries, dewberries, a very few raspberries, pomegranates, bananas, jujubes and pawpaws. There are a few other tropical fruits that are grown only for specimens.

Louisiana abounds in beautiful flowering shrubs and wild flowers. The planting of all kinds of ornamentals is very extensive, roses bloom throughout the season,

and the camellia finds a congenial home throughout the southern part of the state. In and around New Orleans the finest ornamental plantings will be found.

Although quantities of nursery stock are grown in Louisiana, many trees, vines, shrubs, cuttings and seeds are brought from other states and from abroad. Several kinds of ornamental plants are imported mainly from Europe, these being handled chiefly by florists in New Orleans. Some florists specialize in growing certain ornamentals, and have built up a large trade with such plants as roses, ferns, orchids and cape jessamines, shipping numbers of them to northern points. Outside of New Orleans, but few florists do anything more than a local business.

Besides ornamental plants, including shade trees, the principal nursery stock produced in the state consists of deciduous fruit- and nut-trees, citrus and fig varieties, and strawberry and grape-vines. Of the deciduous fruits, peach is the leading one, being most generally grown in the northern uplands. While blight is a serious drawback to pear-growing, yet the Kieffer succeeds well on nearly all kinds of soil. Plums and rarely apples are planted in home yards, and sometimes the quince may be seen. The mulberry is a common tree, being valued mostly for its shade, while poultry or hogs are usually allowed to feed on its fruit. Excepting the Japanese walnut and chestnut, of which few trees are known to be of bearing age, the pecan is almost the exclusive nut produced as a crop. Numbers of trees grow practically wild as seedlings, yet the select varieties have been widely planted in both yards and orchards, some of the latter covering extensive areas. The chief nurseries supplying all of these desirable trees and other plants in general are located in the northwestern part of the state. The largest producer of stock owns a place near Shreveport and makes large shipments into adjoining states. A great abundance of young pecan trees have been propagated in nurseries on or bordering the alluvial lands along the Mississippi and lower Red River. The propagation of citrus stock is practically confined to the orange belt comprising the delta and inner coastal lands. In the southwestern section about Lake Charles, the fig has proved to be a profitable crop, the Magnolia making a choice preserve, and nurseries and orchards have been planted with this kind of growth in particular. The pomegranate occasionally occupies a place in the yard also. Strawberry plants are sold by most of the leading crop-producers in Tangipahoa Parish, the main region in which the fruit is grown, but deliveries are generally local. A very few growers in the central and southwestern parts attempt to sell plants from their fields. In the north central sections, grape-culture has showed possibilities of expansion, and the established vineyardists supply stock from their nurseries. Blackberries and dewberries run wild to such an extent that little demand is made for these plants.

Public-service agencies for horticulture.

The Louisiana State University and Agricultural and Mechanical College at Baton Rouge has a department of horticulture and forestry with one professor in charge. The Agricultural Experiment Stations of the University (founded 1887) have one member of the staff at Baton Rouge who conducts the investigations and extension work with truck crops, and another member engaged in horticultural investigations at the North Louisiana Experiment Station, Calhoun.

The Louisiana Industrial Institute, at Ruston, the Southwestern Louisiana Industrial Institute, at Lafayette, and the State Normal, at Natchitoches, as well as the agricultural high-schools, offer horticultural instruction in connection with the general agricultural courses.

The entomologist of the experiment stations inspects the nurseries of the state and imported plants for dangerously injurious insects, diseases and other pests.

Statistics (Thirteenth Census).

In 1910 the approximate land area of Louisiana was 29,061,760 acres. Of this acreage, 35.9 per cent or 10,439,481 was land in farms. Of the land in farms, 5,276,016 acres were improved; 4,316,561 acres were in woodland; and 846,904 was the acreage of other unimproved land in farms. The number of all the farms in 1910 was 120,546, the average acreage being 86.6 to a farm. [The total area is 48,506 square miles.]

The leading agricultural crops of the state are cereals, cotton, sugar crops, and hay and forage. The cereals are by far the most important. In 1909, the acreage devoted to cereals was 1,938,357 and the value of cereal products, \$24,786,984, or 32 per cent of the total value of all the crops. The acreage occupied by cotton decreased from 1,376,254 in 1899 to 957,011 in 1909, when the value of the cotton produced was \$20,274,747. The acreage of sugar crops increased from 277,903 in 1899 to 331,375 in 1909, when the value of the products was \$17,787,054. Hay and forage increased in acreage from 97,136 in 1899 to 180,811 in 1909, an increase of 86.1 per cent, when their value was \$2,433,101. The value of the forest products of the farms was \$3,584,340 in 1909, as compared with \$1,381,867 in 1899.

Horticultural crops of the state are fruits and nuts, potatoes and other vegetables, small-fruits, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$714,269, as compared with \$291,587 in 1899. In 1909 the total acreage of potatoes and other vegetables, the most important of the horticultural crops, was 114,829, as compared with 63,098 in 1899, and their value in 1909 was \$6,282,904. Small-fruits increased in acreage from 1,408 in 1899 to 3,587 in 1909, when their value was \$486,988. Flowers and plants and nursery products increased in acreage from 365 in 1899 to 729 in 1909, an increase of 99.7 per cent, when their value was \$213,855.

The total quantity of orchard-fruits produced in 1909 was 392,607 bushels, valued at \$314,027, an increase over the value and production in 1899. In 1909 the most important of the orchard-fruits were the peach and nectarine which contributed about three-fourths of the production; pears, apples, and plums and prunes producing most of the remainder. The number of peach and nectarine trees of bearing age in 1910 was 903,352; those not of bearing age, 316,132. The production in 1909 was 290,623 bushels, valued at \$228,084. The pear trees of bearing age in 1910 numbered 57,630; those not of bearing age numbered 38,242. The production in 1909 was 35,554 bushels, valued at \$31,069. The number of apples trees of bearing age in 1910 was 93,304; those not of bearing age numbered 96,544. The production in 1909 was 33,875 bushels, valued at \$28,744. The production of plums and prunes for the same year was 31,473 bushels, valued at \$24,641. Small amounts of cherries, quinces, apricots, and mulberries were also produced.

The grape-vines of bearing age in 1910 numbered 31,041; those not of bearing age numbered 20,936. The production in 1909 was 106,595 pounds, valued at \$6,099, as compared with \$5,927, their value in 1899.

The total production of nuts in 1909 was 796,925 pounds, valued at \$73,169. The most important of the nuts are the pecans. In 1910 the pecan trees of bearing age numbered 36,527; those not of bearing age, 119,547. The production of pecans in 1909 was 723,578 pounds, valued at \$70,635; that of Persian or English walnuts, 15,173 pounds, valued at \$1,446; that of black walnuts, 54,624 pounds, valued at \$970; and a small amount of almonds.

Tropical fruits increased in value from \$8,727 in 1899 to \$320,974 in 1909. The most important of the tropical fruits is the orange, of which, in 1909, there were produced 149,979 boxes, valued at \$222,339. The number of orange trees of bearing age numbered 266,116 in 1910; those not of bearing age, 155,016. The fig trees of bear-

ing age in 1910 numbered 71,464; those not of bearing age, 102,043. The production of figs in 1909 was 2,025,308 pounds, valued at \$87,009. Other tropical fruits produced were: 3,340 boxes of mandarins, valued at \$5,945; 1,781 boxes of pomelos (grapefruit), valued at \$1,069; 303 boxes of lemons, valued at \$713; and 300 boxes of tangerines, valued at \$500.

Of the vegetables grown in Louisiana, the sweet potato and yam are of most importance. From an acreage of 56,953, in 1909, there were produced 4,251,086 bushels, valued at \$2,357,729. The production of peanuts from 25,020 acres was 412,037 bushels, valued at \$422,232; the production of potatoes from 19,655 acres was 1,183,525 bushels, valued at \$924,311. Other vegetables produced were: 1,962 acres of cabbage, valued at \$208,678; 2,909 acres of onions, valued at \$147,377; 515 acres of lettuce, valued at \$94,321; 1,278 acres of watermelons, valued at \$69,386; and sweet corn, 1,218 acres, valued at \$62,060. Vegetables of less importance were green beans, beets, cantaloupes and muskmelons, carrots, cucumbers, okra, parsley, green peas, green peppers, radishes, spinach, tomatoes and turnips.

The acreage devoted to the production of flowers and plants increased from \$9 in 1899 to 227 in 1909. The total area under glass in 1909 was 347,473 square feet, of which 260,711 were covered by greenhouses and \$6,762 by sashes and frames. The value of the products in 1909 was \$126,212, as compared with \$76,628 in 1899.

The acreage occupied in the production of nursery products increased from 276 in 1899 to 502 in 1909, an increase of 81.9 per cent. The value of the products for the same time increased from \$63,593 in 1899 to \$87,643 in 1909.

GEORGE L. TIEBOUT.†

Oklahoma.

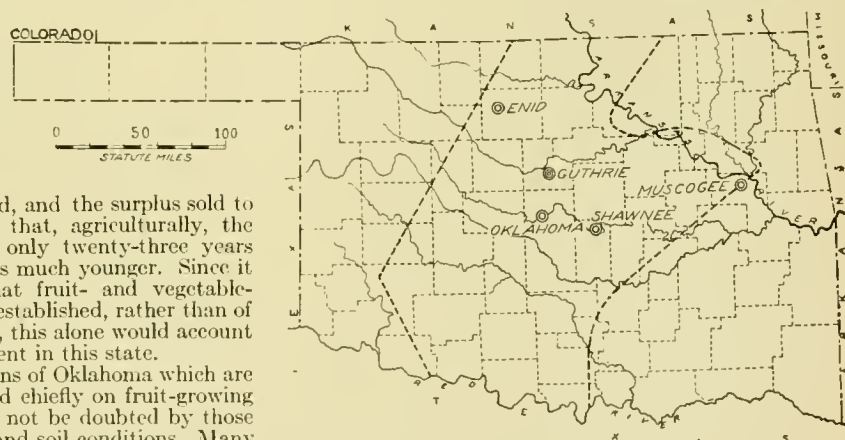
At present, the horticulture of Oklahoma (Fig. 2522) is but poorly developed. The reason for the state being backward in fruit-growing and vegetable-raising is because of the short length of time since the commonwealth was first settled. The first part of Oklahoma was thrown open to settlement in 1889. Other sections adjoining were opened to entry from time to time until 1908, when the old territory of Oklahoma was combined with Indian Territory to form the present state. Even today, much of the Indian land is still held in reserve, but is gradually being allotted, and the surplus sold to white settlers. This means that, agriculturally, the oldest part of Oklahoma is only twenty-three years old, and that the remainder is much younger. Since it is a well-recognized fact that fruit- and vegetable-growing are industries of old established, rather than of young pioneer neighborhoods, this alone would account for the lack of this development in this state.

That there are many sections of Oklahoma which are destined eventually to depend chiefly on fruit-growing as a means of livelihood will not be doubted by those who investigate its climatic and soil conditions. Many neighborhoods in those parts of Arkansas, Missouri, and eastern Kansas which lie contiguous to Oklahoma are notably well adapted to fruit-growing, and there is every reason for presuming that neither soil nor climate varies materially on crossing the state line. Many of the fruit sections of Oklahoma are embraced in the old Indian Territory, and are consequently the newest part of the state.

It is manifest from the above statements that no Census reports of crops produced in this state are of any present value, except that of 1910, and that this is only of limited application.

There is little question but that Oklahoma is on the southern border of the apple-growing region. While one would not wish to say that it is impossible for market varieties to be produced which will be adapted to this southern country, they are unknown today. The pressing need of the apple-growers is for later and better-keeping varieties. Sorts like the Ben Davis, Jonathan, Missouri Pippin, and other standards of Kansas, Missouri and Illinois, ripen in late September or early October there, but in Oklahoma they are fully mature in early September. At this time the weather is still very warm and decay will frequently set in at once. This means that the Oklahoma grower must either depend on cold storage from the start or else confine himself wholly to the local market. On this account, apple-growing has hardly reached a commercial phase in any part of Oklahoma, although there is no question but that there are certain neighborhoods in the eastern part of the state which are very well adapted to the production of this fruit.

Commercial peach-growing is much more promising than the growing of any other fruit. It is difficult to say exactly where the peach districts are. In very favorable years, good crops of this fruit are secured in sections well into the western part of the state. These western neighborhoods, however, are not as certain producers of peaches as those farther east. It is probable that the eastern and southeastern part of Oklahoma comprises most if not all of the sections which are so well adapted to peach-raising that this will become the predominant industry. This is not only because this region has the characters that adapt it to the growing of peaches, but also because it has not the characters which make it good for general farming. For it has been observed everywhere that no country goes into fruit-raising so unreservedly as those which cannot make a good living any other way. Much of the land in the eastern part of Oklahoma belongs to what is known as the Ozark country. These Ozarks are a rough tableland, characterized generally by a rather thin soil. This thinness of soil, combined with the roughness, puts the grain-raiser at a disadvantage as



2522. Oklahoma, showing horticultural divisions of the state.

compared with the raiser of fruit. This is the newest part of Oklahoma and much of it is still in the hands of the Indian owners, and some of the most interesting orchards belong to these people. It only needs the presence of experienced fruit-growers to change many of these neighborhoods from poor one-horse grain- and pig-farming sections to profitable fruit-raising districts. Unfortunately, during the last few years, when this country has been settling, fruit-raising has been so profitable in other states that there has been

but little inducement for experienced growers to come into Oklahoma. Most of the peach-growers here at present have picked up the business, and have acquired such knowledge as may be gained by experience alone, without any training, and without learning the details of the business in some other section. This means that there is no system either to the methods of raising or of marketing peaches in this state at present. Some orchards are cultivated, but more are not cultivated. The same thing is true of all other peach-orchard operations. In marketing there is the same lack of uniformity. Peaches are shipped in all sorts of receptacles, from the four- and eight-basket crate to a bushel basket. The flaring top basket of the East is practically never seen.

Pears do not seem to be a very promising commercial proposition, except possibly in the southern and eastern counties. The reason for this is generally blight and lack of fruitfulness. There are many neighborhoods in which, in most years, pears may be raised for home use or local market with considerable success.

The status of plum- and prune-raising is practically the same as that of pears. The European or domestica plums do not seem to be well adapted to the mid-western conditions. The native varieties do well, but are not well adapted to commercial uses on account of their softness and a lack of demand on the part of the public. From the standpoint of home consumption, however, the plum is well to the front. Trees of the native varieties thrive, and in spite of the depredations of curculio and black-knot, usually bear. On account of their early fruiting, they are usually the first fruit that the new settler secures for his table. This is particularly true of the *Prunus Watsonii*, or sand-hill plum, a dwarf species inhabiting the western part of the state.

Cherries are raised only for home use, and in most years hardly enough for that. The cherry is rather exceptional in that the middle counties of the state appear to suit this tree better than those of the east. In Oklahoma, however, as in most other states, the cherry is one of the favorite yard trees, and there is probably more of this fruit raised than the Census figures would indicate.

The apricot is in much the same condition as the cherry. The central and south-central counties, although there are few or no apricot orchards, raise much of this fruit in yards and roadsides. The apricot is a much surer crop in this state than in any of the northern states, and the trees seem resistant to all the vicissitudes of our seasons.

Grapes are raised to a considerable extent for home eating, but there are practically no commercial vineyards. Although the grape is found native in nearly every part of the state, it is confined chiefly to the streams, and it by no means necessarily follows that the cultivated uplands are adapted to this fruit. That the common commercial varieties, composed, as they are, chiefly of *Labrusca* blood, suffer from the heat and droughts of our season, is unquestioned. In spite of this, the most commonly raised varieties belong to this *Labrusca* class. This is probably owing to the Oklahoma public having become accustomed to the taste of these grapes, and hence preferring them to the fruit from the stronger vines of the *æstivalis* and *riparia* class.

While the development of strawberry-growing is very small, there is every reason to believe that this will eventually become a large industry in the eastern and northeastern parts of the state. This part of the commonwealth has a climate and soil which is almost identical with the nearby strawberry regions of Missouri.

Blackberries and dewberries do very well in Oklahoma, and the only reason that there are not more commercial plantings is on account of the lack of insistent

demand for the fruit. The dry winters of the prairies winter-kill the vines somewhat, but they are a comparatively sure crop, even in this part of the state.

Raspberries, currants, and, to a considerable degree, gooseberries, are apparently not adapted to the climate here. Most of the growers have abandoned these fruits, and many of them report absolute failure, after repeated efforts.

The growing of pecans is attracting very much interest in the state, chiefly on account of the immense profits reported from the South, and the fact that the trees grow wild over a large part of the state. So far as tested, the named Gulf coast sorts have proved tender to our winters, although not nearly all of these Gulf coast varieties have been tested. At present there is considerable money being made in some neighborhoods by selling the fruit from the wild trees, and some of the growers have been cutting out the trees bearing the smaller and poorer nuts and retaining those bearing the larger and thinner-shelled nuts. There is considerable overflow land in the state which seems to suit pecans particularly well, and to be adapted to but little else. It is probable that pecan-growing will occupy a prominent place in the ultimate agriculture of the state, although it will be slow in coming.

Of vegetables, there are only two grown in this state in sufficient quantities to attract the attention of the census enumerator and deserve mention here. They are the potato and the sweet potato. Although both these vegetables are raised more or less all over Oklahoma, they become commercial propositions only in the lighter soils, contiguous to the Canadian and Arkansas rivers. The growing of potatoes is chiefly the producing of early potatoes for the late June and July market. During the last few years, owing to the very high prices asked for the northern potatoes shipped into Oklahoma in the fall, the Oklahoma growers have been striving to raise late potatoes as well. In many sections, the growers raise two crops a year, digging the first crop about the first of July, when the second crop is at once planted. The yields here are not nearly so large as in the northern potato regions, but the prices are very much higher than are ever known in that section. The growing of early potatoes is an apparently stable industry, for there are few other parts of the South so favorably situated for producing early potatoes as the above-mentioned parts of Oklahoma. The growing of late potatoes, however, depends apparently on the railroads. As long as rates remain so high that fall potatoes from the North bring over \$1 a bushel in this state, there will be a profit in raising them in Oklahoma. This is true in spite of the fact that analyses have shown that our southern-grown potato is not so rich in starch as those from farther north. On occasional years, early hot winds will seriously damage this crop.

There is no doubt of the adaptability of sweet potatoes to the climate of this state, and to much of the soil. Perhaps it is partly on account of the large contingent of northern farmers that the growing of sweet potatoes is not a more prominent industry than it is. The acreage of this vegetable is much less than of Irish potatoes. The sweet potato sections are practically the same as for the potato, except that the Red River Valley is also a contributing factor. The price of sweet potatoes, in the towns of Oklahoma, is usually good at all seasons. But few of the growers are familiar with any reliable methods of keeping the potatoes, so that generally the supply is confined to the fall months. Sweet potatoes are nearly, if not quite, immune to all the vicissitudes of the Oklahoma climate, but commercially they are confined to the sandy bottoms.

There are many other vegetables which grow well enough in this state to be promising commercial undertakings, but they have not yet been tested in any except the most primitive way. Some of these are muskmelons, watermelons, onions, peanuts, and pos-

sibly beans. Here, as with potatoes, the railroad factor has been an important one. This and other difficulties in marketing are preventing a greater development of these industries.

Public-service agencies for horticulture.

The Land-Grant college of Oklahoma, known as the Agricultural and Mechanical College, was established in 1890 at Stillwater, in Payne County. There are three members of the horticultural staff.

The State Experiment Station is also at Stillwater, and is run in connection with the College. There are two members on the horticultural staff. Between twelve and fifteen bulletins and circulars have been issued on horticultural subjects.

There are no schools in the state giving particular attention to horticulture. A few schools are teaching a limited amount of horticulture along with the agricultural work.

Inspection of nurseries is conducted by the State Nursery and Orchard Inspector, who is the entomologist of the Experiment Station.

Statistics (Thirteenth Census).

The approximate land area of Oklahoma in 1910 was 44,424,960 acres. The land in farms was 65 per cent of the land area, or 28,859,353 acres. Of this land in farms, 17,551,337 acres were designated improved land in farms; 3,568,910, woodland; and 7,739,106 as other unimproved land in farms. The number of farms in Oklahoma in 1910 numbered 190,192, 151.7 being the average acreage to a farm. [The total area is 70,057 square miles.]

The leading agricultural crops of the state are cereals, cotton, including cotton seed, hay and forage, and broom-corn. The acreage devoted to cereals increased from 4,431,819, in 1899, to 8,248,653 in 1909, when the production was valued at \$71,798,662. Cotton, including cotton seed, increased from an acreage of 682,743, in 1899, to 1,976,935 in 1909, when the production was valued at \$41,187,408. Hay and forage increased in acreage from 1,095,706, in 1899, to 1,347,598 in 1900, when the production was valued at \$9,638,648. Broom-corn increased in acreage from 12,763, in 1899, to 216,350 in 1909, when the production was valued at \$2,559,235. The value of forest products of the farms in 1909 was \$1,602,720, as compared with \$456,240 in 1899.

Horticultural crops grown in Oklahoma are fruits and nuts, small-fruits, potatoes and other vegetables, flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$1,127,710, as compared with \$518,502, in 1899. Small-fruits increased in acreage from 1,388, in 1899, to 2,745 in 1909, when the production was 2,310,367 quarts, valued at \$202,291. The total acreage of potatoes and other vegetables in 1909 was 88,362, and their value, \$4,210,844. Excluding potatoes, the acreage of other vegetables increased from 33,463, in 1899, to 51,011 in 1909, when the production was valued at \$2,610,239. Flowers and plants and nursery products increased in acreage from 813, in 1899, to 897 in 1909, when the production was valued at \$263,968.

The total quantity of orchard-fruits produced in 1909 was 1,137,288 bushels, valued at \$943,464. Apples contributed nearly two-thirds of this quantity, and peaches and nectarines most of the remainder. The apple trees of bearing age in 1910 numbered 2,955,810; those not of bearing age, 2,060,384. The production in 1909 was 742,182 bushels, valued at \$573,076. The number of peach and nectarine trees of bearing age in 1910 numbered 4,783,825; those not of bearing age, 2,574,680. The production in 1909 was 357,644 bushels, valued at \$326,315. The production of plums and prunes was 25,916 bushels, valued at \$28,134; that of pears, 7,450 bushels, valued at \$9,248; that of cherries, 2,372 bushels, valued at \$4,393; that of apricots,

1,123 bushels, valued at \$1,270; and that of quinces, 601 bushels, valued at \$1,028.

The production of grapes in 1909 was 3,762,727 pounds, valued at \$122,045. The production in 1899 was 6,344,031 pounds. The grape-vines of bearing age in 1910 numbered 2,388,213; those not of bearing age, 447,489.

The total production of nuts in 1909 was 1,019,238 pounds, valued at \$62,168, as compared with 45,330 pounds produced in 1899. The production in 1909 consisted of 894,172 pounds of pecans, valued at \$59,481; 94,659 pounds of black walnuts, valued at \$1,591; 6,700 pounds of Persian or English walnuts, valued at \$489; and 21,250 pounds of hickory-nuts, valued at \$485.

Blackberries and dewberries are the most important of the small-fruits, with strawberries second in importance. The acreage of blackberries and dewberries increased from 683, in 1899, to 1,792 in 1909, when the production was 1,366,497 quarts, valued at \$119,654. The acreage of strawberries increased from 626, in 1899, to 825 in 1909, when the production was 830,404 quarts, valued at \$71,296. Raspberries and loganberries increased in acreage from 43 in 1899, to 85 in 1909, when the production was 74,104 quarts, valued at \$6,851. Other small-fruits produced were 31,024 quarts of currants, valued at \$3,559, and 8,276 quarts of gooseberries, valued at \$923.

The acreage of potatoes increased from 15,360, in 1899, to 32,295 in 1909, when the production was 1,897,486 bushels, valued at \$1,250,052. Sweet potatoes and yams increased in acreage from 3,576, in 1899, to 5,056 in 1909, when the production was 359,451 bushels, valued at \$350,553. Other leading vegetables produced in 1909 were: 5,923 acres of watermelons, valued at \$165,725; 386 acres of onions, valued at \$29,143; 655 acres of cantaloupes and muskmelons, valued at \$23,438; 315 acres of tomatoes, valued at \$19,295; 548 acres of sweet corn, valued at \$9,138; 137 acres of cabbage, valued at \$9,510. Vegetables of less importance were green beans, pop-corn, green peas, and rhubarb.

The acreage devoted to the production of flowers and plants increased from 9, in 1899, to 40 in 1909. The area under glass in 1909 was 158,515 square feet, of which 148,737 were covered by greenhouses, and 9,778 were covered by sashes and frames. The value of the flowers and plants produced in 1909 was \$92,016, as compared with \$6,644 in 1899.

Nursery products increased in acreage from 804, in 1899, to 857 in 1909. The production in 1909 was valued at \$171,952, as compared with \$103,264 in 1899.

N. O. BOOTH.

Texas.

Texas (Fig. 2523) extends in north latitude from 26° to 36½°, and in west longitude from 93½° to 106½°. Its altitude varies from sea-level, for over 400 miles along the Gulf coast, to 9,000 feet in Mt. Guadalupe, west of the Pecos River. It has a greater area of arable land in proportion to its entire area than any other state in the Union, except, perhaps, Illinois and Iowa. In 1912 it had about 4,000,000 population, but its rich soils and other natural resources can sustain, in comfort, a greater population than has Germany. There are no less than eleven rivers wending their way through the state, or by it, from northwest to southeast, the shortest of which is at least 400 miles long. It has no lakes worthy of mention, but has connected large bays, or sounds, land-locked by long islands, next the Gulf, along its entire coast, navigable for sloops and steamboats. The climate is healthful and invigorating.

The climatic belts of the state are distinctly marked and extremely different in character, one from another. They may be designated as follows:

(1) The Gulf Coastal Plain; (2) The East Texas Forest region; (3) The Red River Valley; (4) The Black Waxy Prairies; (5) The Brown or Chocolate Plains; (6) The Staked Plains; (7) The Pecos Valley; (8) The Rio Grande Valley; (9) The Mountain region.

The Gulf Coastal Plain, extending out 50 to 75 miles from the Gulf of Mexico, varies in altitude from a few feet along the low sandy beach, to 50 and rarely 100 feet inland. Its surface in places is timbered with live-oak and pine, but mostly it is a level, black-sandy prairie. The streams are bordered in southeastern Texas with timber and undergrowth of many species, including the grand magnolia, holly, palms and many other beautiful flowering trees, shrubs, and perennial herbs. The rainfall in the southwestern extension of

in the coast country. The canned-fig industry is developing and promises to become very profitable. Dewberries grow to perfection, and wild varieties are marketed in considerable quantities. The Le Conte, Kieffer, and Garber pears do better in this region than elsewhere. Some of the Chinese Cling group of peaches, also the Honey and Peen-to types, succeed well. Japanese plums, persimmons, and various American and foreign grapes also succeed, the latter requiring to be grafted on phylloxera-resistant roots, which are found in the numerous wild vines of the state.

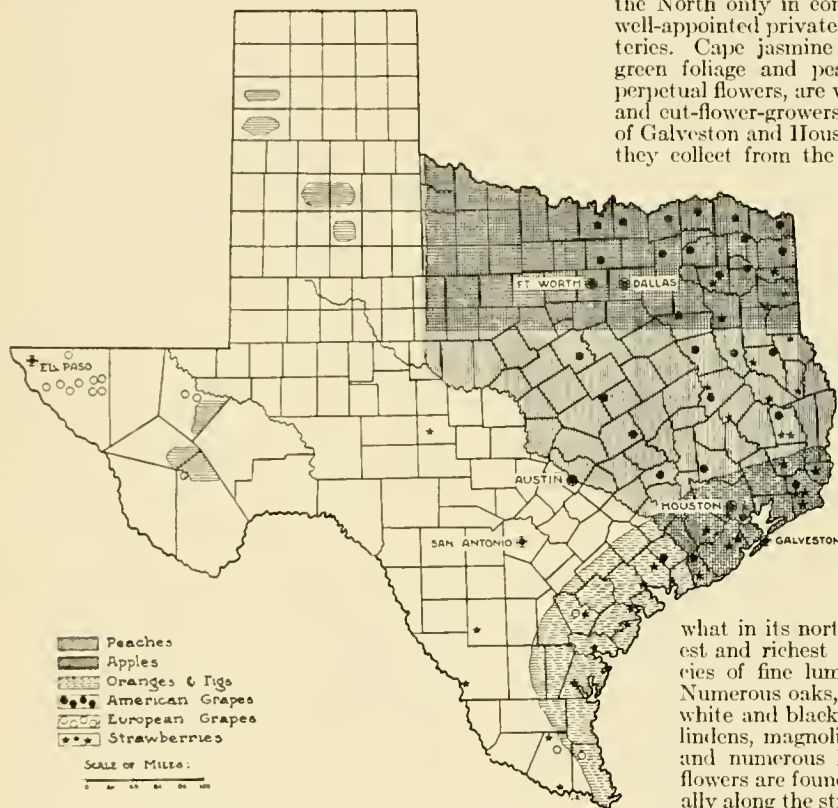
Ornamental horticulture, in all its branches, is here characterized by a profusion and luxury of growth in foliage and flower of a semi-tropical nature. Ever-blooming roses continue to flower most of the winter. Broad-leaved evergreen trees and shrubs, known in the North only in conservatories, are here seen in all well-appointed private grounds, and in parks and cemeteries. Cape jasmine hedges, with their dark glossy green foliage and pearly white, camellia-like, sweet perpetual flowers, are very popular. Commercial plant-and cut-flower-growers do a good business in the cities of Galveston and Houston. During the winter holidays they collect from the woods great quantities of long ("Spanish") moss, holly, magnolia, mistletoe, palmetto, smilax, and the like, and ship to northern cities for decoration purposes. In May and June they send to northern florists great numbers of cape jasmine and magnolia flowers.

The great East Texas Forest region lies just north of the eastern end of the Coastal Plain, the city of Beaumont being situated in its southern extremity. Extending westward from the Sabine River on the east to the Navasota River on the west, over 150 miles, and northward to Red River about 300 miles, narrowing some-

what in its northern parts, is one of the grandest and richest forests in America. There species of fine lumber pines are most abundant. Numerous oaks, hickories, elms, maples, beeches, white and black walnuts, gums, poplars, pecans, lindens, magnolias, holly, persimmons, sassafras, and numerous handsome shrubs and perennial flowers are found almost everywhere, but especially along the streams. The soil is generally very sandy, underlaid with red and yellow clay, and well adapted to fruits of almost all kinds. The

altitude varies from 100 to 600 feet. The rainfall is ample—from 40 to 60 inches annually—and the climate is very mild. Owing to the great lumber-mill interests and lack of market facilities, nearly all horticultural pursuits have been overshadowed until recently. But at Palestine, Tyler, Troupe, Longview, Nacogdoches and some other points, large commercial peach orchards, berry plantations and canneries have been in very successful operation for a number of years and these interests are rapidly increasing. Railway facilities are growing, and altogether east Texas has a very bright horticultural future. Trucking of nearly all kinds, and fruit-growing, with berries, peaches, plums, apples (especially in northern parts), and pears, could hardly ask for better natural conditions.

The Red River Valley is a long extension to the westward—some 250 miles—of the soil, climatic and forest conditions of east Texas, excepting the pines, gums, and some other trees in its western parts. But, as the Red River runs eastward in a broad, deep,



2523. Texas, to show the main horticultural areas.

this belt is much less than in the eastern, where it averages about 50 inches annually, and the growth and cultural conditions vary accordingly. In trucking, celery, cabbage, strawberries, tomatoes and melons are the leading items. On the southern end of Padre Island, near Brownsville, bananas, oranges and pineapples are grown to some extent. Oranges were successfully grown and fruited along the Gulf coast for several years, but in November, 1911, a severe freeze occurred, before the wood was ripe, and killed all the trees back to the hardy trifoliata stock, where not protected by a mound of soil. Those mounded-up were uninjured below the soil, and made fine growth the summer following. This promised to be an important industry in southern Texas, but will be checked somewhat in its progress by this disaster. To permit of mounding-up safely, growers recommend budding and grafting not over 2 or 3 inches above ground, but never below, as the Satsuma would get onto its own root, and be more tender. Figs flourish everywhere

heavily timbered valley, its southern bluffs, some 5 to 10 miles wide, enjoy peculiar immunity from late frosts. Here apples flourish about as well as in northern Arkansas, and peaches have not failed entirely in fruit in almost forty years.

With the exception of a few of the tenderer shrubs, everything is grown here as well as in east Texas, and apples, grapes and some other fruits grow better and acquire higher color and flavor, owing to a less humid atmosphere. In this belt belong the cosmopolitan little cities of Texarkana, Paris, Sherman, Denison and Gainesville, in which are found many beautiful residences and grounds, many orchards, vineyards, and berry plantations. Railway facilities are excellent, and good markets lie in every direction. Trucking also is extensive. Cut-flower and general nursery business flourish in the places named.

Similar conditions prevail in some parts of the Trinity River Valley as along Red River, especially about Dallas and Fort Worth; also on the Brazos at Waco, but more of the southern type. These three cities nestle in the heart of the next great division.

The Black Waxy Prairie region of Texas lies next to east Texas on the west and to the Red River Valley on the south, extending west to about 98° and south to within 150 to 100 miles of the Gulf, a broken irregular arm of the east Texas region extending south-westwardly between it and the Coastal Plain. This region has an altitude in its southern parts of 400 to 500 feet and rises in the northwest to 1,000 feet or more. The rainfall varies from 50 inches or more in its eastern parts to 30 inches in the western parts. The foundation is white chalky lime-rock, the soil very black, sticky and exceedingly rich, highly adapted to grains, grasses and cotton, but not suitable for most fruits. The stone-fruits and blackberries do best. Onions are largely grown in Collin County of which McKinney is county-seat. Most shrubbery does well. The Bermuda-grass flourishes in Texas wherever grass can grow and is the almost exclusive lawn-grass. Very handsome yards are made by some of the farmers and many who live in the towns and cities; but most farmers in Texas have done little or nothing to beautify their homes horticulturally.

The Brown, or Chocolate Plains region of Texas, devoted principally to grazing and small grains, lies to the westward of the Black Land Region, is about 200 miles wide by 600 long, extending from Oklahoma on the north to the Rio Grande on the south, running from 1,000 feet altitude on the south and east to 3,000 feet on the west, where it ends suddenly against the cliffs of the still higher Staked Plains region.

Horticulture is in its infancy in all this vast semi-arid, high, rolling prairie country, and can do little without irrigation. Yet many wealthy stockmen there have beautiful grounds surrounding their homes, and grow their home supplies of very fine fruits. Of commercial horticulture there yet is none. The same may be said of the Staked Plains region, but its soil is dark rich loam, the country almost a dead level, except where cañons have cut into it, its altitude from 3,500 to 4,500 feet, its climate dry and very salubrious. Irrigation-horticulture in a small way is sustained from driven wells, which strike plenty of water at 10 to 30 feet. Stock-grazing is the chief commercial occupation, small grain coming next. Five or six counties northwest from Austin, in the central parts of the Chocolate Belt, are very broken, hilly and picturesque, well adapted to fruits. Nearly every home there is supplied with fruits.

The Pecos Valley lies just west of the Staked Plains, and east of a spur of the Rocky Mountains. In places it is irrigated, as at Roswell and Carlsbad, New Mexico, and Pecos City and Stockton, Texas. Commercial fruit-growing is considerable in this valley, especially at Roswell and Pecos City. At the latter place is a vineyard of 40 acres of the vinifera varieties, planted

twenty years, doing finely on their own roots and very profitable, as the fruit goes to market in northern cities before any grapes are ripe in California. The Stockton region is largely irrigating and planting vinifera grape, pears, alfalfa and so on.

The Rio Grande Valley is much warmer in the same latitude than the Pecos Valley, otherwise the horticultural conditions are much the same. At El Paso and Ysleta, a little way south on the Texas side, considerable quantities of vinifera grapes of table varieties are grown under irrigation and shipped to other parts of Texas and to northern cities in August and September. Pears and plums are also grown to some extent. Farther down on the Rio Grande, at Del Rio, Eagle Pass and Laredo, grapes, figs and onions are considerably grown and shipped to the larger Texas cities and the North. The grapes are of the Old World varieties, and ripen in June; consequently they have no competition and bring fine prices. The conditions are such that immense quantities of as fine grapes of this class can be grown in this part of Texas as in the best regions of California, and the cost of getting to market is not more than half as much. Undoubtedly the triangular region between San Antonio, Laredo and Del Rio will in the near future have extensive commercial vineyards of vinifera grapes.

A vast mountainous and dry-plains region extends from the Pecos to the Rio Grande, devoted to goats, sheep and cattle; yet at Fort Davis, on a beautiful mesa, some 5,000 feet altitude, among mountains 2,000 to 4,000 feet higher, are a good many very beautiful homes, and fruits do finely, as there is sufficient rainfall and the air is very pure, so that diseases are almost unknown.

The Spanish taste in home grounds among the wealthy of southwestern Texas, who are chiefly stock-growers and merchants, is sometimes seen. It consists of a plaza, or open square in the center of the residence, having fountains (where water is to be had abundantly), and borders, beds and vases of rare tropical and sub-tropical flowers, shrubs and fruits. Around this highly artistic garden the house is built, often of adobe, sometimes of stone, cut and carved, in large rooms adjoining and opening into each other, all on the ground-floor and one large door opening out to the street or small front yard from a big hall, sometimes having grand arches and marble columns. No windows are in the outside walls, except perhaps in the front, the rooms all being lighted from within the plaza. Thus great seclusion is secured and a perpetual conservatory scene is had from every room. Paved walks, usually covered, run around the plaza next the rooms and similar walks cross through the plaza. This style has given way to American styles. The plaza-park prevails also in the finer hotels, as seen in some at San Antonio; and these, on an enlarged scale at various places in the denser parts of the city, give a very refreshing appearance. In the central and western parts of the state the northern and eastern style of park, cemetery and private grounds decoration is mostly copied, as is also the architecture. Some very creditable examples are seen in Dallas, Waco, Austin, Paris, Sherman, Gainesville, Fort Worth and other places.

There are numerous small, and a few fair-sized nurseries scattered over the state. Plant and cut-flower business is developing rapidly in the larger cities.

Seed business is almost entirely commercial or jobbing, few being engaged in growing seeds of any kind as a business, and the supply comes from northern and eastern growers except the grains.

The following persons, now deceased, have occupied a prominent place in the development of Texas horticulture: T. V. Munson, Denison; H. M. Stringfellow; Wm. Watson; A. M. Ramsey, Austin; C. Falkner, Waco; E. H. Adams, Bonham; J. C. Newberry, Pilot Point; J. T. Whitaker, Tyler.

Public-service agencies for horticulture. (E. J. Kyle.)

The legislature of Texas, in an act approved April 17, 1871, provided for the establishment of the Agricultural and Mechanical College of Texas, which was located at College Station in Brazos county. The College was formally opened for the reception of students October 4, 1876. The Horticultural Department of the College now has four members on its instructional staff.

The Federal Experiment Station is located at College Station. The horticultural work in the Station is in charge of two men. The Station has published twenty-nine horticultural bulletins and two circulars.

Elementary courses in horticulture are taught in a number of high-schools in the state. There is a considerable amount of extension work done by members of the horticultural teaching staff and members of the extension service. Some of the societies advancing the cause of horticulture in Texas are the Texas State Horticultural Society, Texas Nut-Growers' Association and Texas Nurserymen's Association. There are also several local horticultural societies and many fruit- and truck-growers' associations for commercial purposes.

In the State Department of Agriculture at Austin, considerable time is devoted to the inspection of nurseries, and the eradication of insect pests and diseases.

Statistics (Thirteenth Census).

The approximate land area of Texas in 1910 was 167,934,720 acres. The land in farms was 67 per cent of this area, or 112,435,067 acres. Of this land in farms, the improved land numbered 27,360,666 acres, the woodland 27,658,413 acres, and other unimproved land in farms 57,415,988 acres. The number of all the farms in 1910 was 417,770, and the average acreage to a farm 269.1. [The total area is 265,896 square miles].

The leading agricultural crops of Texas are cotton, including cotton seed, cereals, and hay and forage. The acreage devoted to the production of cotton increased from 6,960,367 in 1899 to 9,930,179 in 1909, when the production was valued at \$188,673,954, which was 63.3 per cent of the total value of all crops. Cereals decreased in acreage from 6,932,791 in 1899 to 6,716,304 in 1909, when the value of the production was \$67,109,923. Hay and forage increased in acreage from 938,024 in 1899 to 1,311,967 in 1909, when the production was valued at \$12,824,433. The value of the forest products of the farms in 1909 was \$8,925,662, as compared with \$3,520,033 in 1899.

Horticultural crops grown in Texas are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$1,824,543, as compared with \$1,563,745, in 1899. Small-fruits increased in acreage from 3,904 in 1899 to 5,053 in 1909, when the production was 6,182,742 quarts, valued at \$480,331. The total acreage of potatoes and other vegetables in 1909 was 202,792, and their value \$12,122,255. Excluding potatoes and sweet potatoes and yams, the acreage of the other vegetables increased from 111,899 in 1899 to 124,690 in 1909, when the production was valued at \$8,099,306. The acreage of flowers and plants and nursery products increased from 2,260 in 1899 to 4,182 in 1909, when the production was valued at \$1,727,470.

The total production of orchard fruits in 1909 was 1,090,233 bushels, valued at \$1,960,998. Peaches and nectarines contributed about two-thirds of this quantity, and apples, pears, and plums and primes most of the remainder. The peach and nectarine trees of bearing age in 1910 were 9,737,827; those not of bearing age, 2,958,813; and the production in 1909 was 729,631 bushels, valued at \$703,649. Apple trees of bearing age in 1910 numbered 1,138,852; those not of bearing age, 1,127,573, and the production in 1909 was 168,008 bushels, valued at \$160,655. Pear trees of bearing age in 1910 numbered 558,478; those not of bearing age,

448,899, and the production in 1909 was 110,967 bushels, valued at \$114,279. Plum and prune trees of bearing age in 1910 numbered 1,020,339; those not of bearing age, 327,765, and the production in 1909 was 75,222 bushels, valued at \$77,925. Other orchard-fruits produced in 1909 were: 1,839 bushels of apricots, valued at \$2,364; 1,635 bushels of mulberries, valued at \$723; 1,869 bushels of quinces, valued at \$740; and 1,062 bushels of cherries, valued at \$663.

The production of grapes in 1909 was 1,802,618 pounds, valued at \$78,325. The grape-vines of bearing age in 1910 numbered 712,201; those not of bearing age, 297,869.

The production of nuts in Texas in 1909 was 5,945,932 pounds, valued at \$562,542. The pecan is by far the most important nut, the production of pecans alone being 5,832,367 pounds, valued at \$556,203. The other nuts produced were: 40,658 pounds of Persian or English walnuts, valued at \$3,703; 16,932 pounds of almonds, valued at \$1,618; and 55,446 pounds of black walnuts, valued at \$995.

Tropical fruits were produced in Texas in 1909 to the value of \$122,678. Figs and oranges contributed the greater part of this quantity. Fig trees of bearing age in 1910 numbered 230,171; those not of bearing age, 585,396. The production of figs in 1909 was 2,411,876 pounds, valued at \$97,078. Orange trees of bearing age, in 1910 numbered 42,384; those not of bearing age, 867,407. The production of oranges in 1909 was 10,694 boxes, valued at \$22,090. Other tropical fruits produced were: 1,175 bushels of Japanese persimmons, valued at \$2,136; 488 boxes of pomelos (grapefruit), valued at \$866; and 224 boxes of lemons, valued at \$469.

Of the small-fruits produced in Texas, strawberries are by far the most important, with blackberries and dewberries ranking next. The acreage of strawberries increased from 1,361 in 1899 to 2,161 in 1909, when the production was 4,207,056 quarts, valued at \$334,651. Blackberries and dewberries increased in acreage from 2,391 in 1899 to 2,773 in 1909, when the production was 1,868,119 quarts, valued at \$138,557. The other small-fruits produced in 1909 were: 97,652 quarts of raspberries and loganberries, valued at \$6,302; 4,873 quarts of currants, valued at \$496; and 5,042 quarts of gooseberries, valued at \$325.

Of the vegetables produced, the sweet potatoes and yams, the potato, and peanut are the most important. The acreage of the sweet potato and yam decreased from 43,561 in 1899 to 42,010 in 1909, when the production was 2,730,083 bushels, valued at \$2,197,799. Potatoes increased in acreage from 21,810 in 1899 to 36,092 in 1909, when the production was 2,235,983 bushels, valued at \$1,825,150. Peanuts increased in acreage from 10,734 in 1899 to 64,327 in 1909, when the production was 1,074,998 bushels, valued at \$1,075,110. Other vegetables of importance, that were produced in 1909, were: 5,170 acres of onions, valued at \$820,972; 6,035 acres of tomatoes, valued at \$597,038; 18,466 acres of watermelons, valued at \$539,313; 4,462 acres of cabbage, valued at \$382,349; 1,784 acres of beans, valued at \$95,474; 1,685 acres of cantaloupes and muskmelons, valued at \$83,363; and 1,256 acres of cucumbers, valued at \$52,667. Turnips were produced to the value of \$39,290; green peppers, to the value of \$18,807; green peas, to the value of \$17,685; sweet corn, to the value of \$13,882; beets, to the value of \$9,420; and asparagus amounted to \$5,372 in value. Vegetables of still less importance were carrots, cauliflower, pop-corn, eggplant, lettuce, okra, pumpkins, radishes, spinach, and squash.

The acreage devoted to the production of flowers and plants increased from 167 in 1899 to 335 in 1909. The total area under glass in 1909 was 986,070 square feet, of which 907,615 were covered by greenhouses, and 78,455 by sashes and frames. The value of the

flowers and plants produced in 1909 was \$474,360, as compared with \$120,249 in 1899.

The acreage devoted to nursery products increased from 2,093 in 1899 to 3,847 in 1909, when the value of the nursery products was \$1,253,110, as compared with \$314,511 in 1899.

T. V. MUNSON.

MOUNTAIN STATES.

Montana.

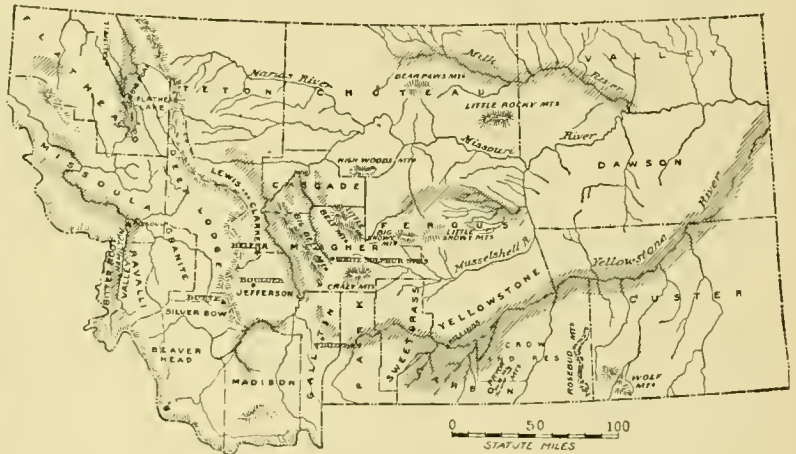
Montana (Fig. 2524) is the third largest state in the Union, Texas and California being first and second respectively. The eastern part of Montana is undulating plains country, with a mean average altitude of 2,800 feet above sea-level. In a mountainous state covering over 145,000 square miles, there are possibilities for great local variations, and Montana is not an exception. From east to west the average length is 535 miles, while from north to south it measures 275 miles. Of the land surface, about 30,000,000 acres are mountainous. The forest reserve embraces over 20,000,000 acres, including some which have agricultural possibilities. About 6,000,000 acres of the tillable lands are under irrigation, or are possible of irrigation, and about the same acreage is possible of cultivation under the dry-farming system.

Along the southern boundary, about 125 miles west of the state line, are the Wolf Mountains; west of these the Rosebud and Pryor mountains; toward the northern boundary and 175 miles west of the state line are the Little Rockies; west of these the Bear Paws; while dotted over the eastern and central part of the state are the Moccasins, and the Big and Little Snowies, the Belts, the Highwoods, and the Crazyes. These, with the exception of the Belts, are isolated from other mountains, or detached spurs from the main range, and abound in the exceptional advantages which arise from good soil, favorable exposure, and convenient means for irrigation. About the center of the southern state line the main range of the Rockies is encountered. This range traverses the state from this point in a north-westerly direction. The summits of the main range vary from 7,500, to 10,000 feet above sea-level, and present mighty barriers to the winter storms which sweep over the country to the east and south of Montana, often bringing intensely cold weather in their wake. The climate of the state is also sensibly affected by chinooks, those much misunderstood currents of warm air which rob winter of its terrors in regions visited by them. The botanist and horticulturist have much to learn, as yet, concerning the effect of altitude upon plant growth. In a general way, it is supposed that 9,000 feet is the so-called limit of timber, although, as a matter of fact, it often happens that above this point the crowns of the mountains are composed of living rock devoid of soil and other needed adjuncts of tree growth. Illustrations of the unwillingness of plant growth to be circumscribed by altitudinal lines are found in the city of Denver, which lies 5,000 feet above sea-level. There many trees have been successfully transplanted from their natural habitat at sea-level along the shores of Puget Sound to a point nearly a mile aloft, and into a climate as naturally dissimilar as could well be found. In Cheyenne, Wyoming, there is a luxuriant development of the black locust at an elevation of 6,100 feet.

This is a tree that has to be most carefully handled to avoid winter-killing in Minnesota, 5,500 feet nearer sea-level.

In the sugar-beet chart of the Department of Agriculture, a great variation of altitude will be found. It is designed to show the extent of the country in the United States adapted to beet-culture. This starts at the Atlantic coast at sea-level, extending due westward to the limit of Wisconsin. From there it jumps to Colorado, California, and also embraces the Yellowstone Valley, which is one of the most prolific sections in the beet area, considering tonnage and sugar-content. One of the largest sugar-beet factories in the United States is located at Billings, which is the largest city in the Yellowstone Valley.

Horticulturally, Montana presents conditions for the growing of a large list of fruits, excepting the citrus and other subtropical fruits. Some scientific experiments have been conducted to determine the species adapted, and much is now being done to determine the varieties of species best suited to Montana's conditions. Observation teaches that all western sections should be carefully studied regarding the presence of alkali, as fruit-trees will not thrive in alkali soil. It is



2524. Montana, with regions best adapted to horticulture.

not usually a hard matter to determine such conditions, as irrigation or natural water-fall brings the salts to the surface where they rapidly crystallize. On the benches near the mountains, which are the desirable fruit-lands, alkali is seldom found.

The natural conditions for fruit-growing in Montana have been such that if trees were planted, a bountiful harvest, in due time, was assured, but with the evolutionary changes of conditions which always follow development, today the degree of success is measured by the skill and aptitude of the grower. Water for irrigation is to be found in abundance. Under irrigation, during the growing season, the moisture-content of the soil is under absolute control, which, combined with the bright sun and the clear atmosphere, makes for a strong normal growth, and by proper regulation of cultivation and irrigation, this growth is properly matured and ripened for the winter.

The lay of the valleys between the mountain ranges, and the frequency of the cañons which open out upon the benches and plains below, create air-currents which are almost a guarantee against frost-injury. These currents can be noticed long distances from the mouths of the cañons, and especially on the benches. They also prevent frosts, which gives the fruit more time for maturity than in the open country, or on level areas.

Pioneer orcharding was started with many obstacles.

Trees were freighted long distances, which made prices almost prohibitive. Seeds were brought across the plains and planted, and, when the trees were of sufficient size, cions came by mail and were grafted into them. In 1864, trees were planted in the Missouri Valley by John G. Pickering, some of which are still bearing. There are bearing orchards in Madison, Clarks Fork, Flathead, and other valleys, that were planted in the early seventies. In 1864, T. W. Harris planted the first apple tree in the Bitter Root Valley, on the bench tributary to Three Mile Creek. He brought the tree by horseback from Walla Walla, Washington. In 1870, the Bass Brothers planted the first commercial orchard in the valley near Stevensville, and in 1898 they marketed about 10,000 boxes of Transcendent crabs. The first McIntosh Reds were planted near Stevensville by Amos Buck in 1877; these trees are still strong, healthy, and productive. This variety early demonstrated its adaptability to Montana conditions, and has proved very remunerative. Early recognizing this fact, and the high quality it develops in Montana conditions, D. E. Bandman planted one of the first commercial orchards near Missoula which consisted of 1,500 McIntosh Reds, and a few other mixed sorts.

The Bitter Root Valley has a mean altitude of 3,300 feet. It is about 100 miles long, lying in the southwestern part of the state, east of the Bitter Root Range. It varies in width from 1 to 20 miles, and is traversed its entire length by the Bitter Root River which empties into the Missoula River near Missoula. The bitter-root flower is very abundant in the Bitter Root Valley and the Missoula Valley. This valley has seen the greatest horticultural development of any section in the state, the Flathead Valley ranking next in order of development; after which come the Missoula Valley, the Plains Valley, the Yellowstone, including its tributary Clarks Fork, Jefferson and South Boulder. The Bitter Root Valley represents as many orchard acres as do the other sections combined. It has a soil especially adapted to apples, cherries, pears, plums, and small-fruits, while in some favored locations grapes and peaches thrive. Sweet cherries, particularly the varieties Bing, Lambert, and Royal Ann, develop a high degree of perfection. The soil is a decomposed granite with a liberal amount of loam, and almost a total absence of alkali. To one unfamiliar with the formation it seems a gravelly, stony, almost worthless combination, but when the cultivator is put into action, water and systematic operations applied, its productive powers are wonderful. The benches, which are the desirable fruit areas, are so fertile that there is a tendency for an overgrowth of tree, and abnormal fruitage. The soil has a liberal mixture of clay, but not sufficient to cause it to bake after irrigation. The orchardists of the Bitter Root Valley have learned that excessive watering has injured more trees than has any other operation. The theory advanced that fruit grown under irrigation is inferior to that grown with a natural rainfall has long since been exploded. The necessary amount of moisture, which can be absolutely controlled under irrigation, coupled with the clear atmosphere, and bright sun, develops a color, and with that goes quality unexcelled. Such conditions can only be found in similar altitudes under irrigation, or systematic frequent, cultural methods. The orchards in the Bitter Root Valley range in size from the home orchard, consisting of about 100 trees including many varieties, to commercial orchards of 100 to 2,000 acres each containing only a few varieties. Many of the large tracts are subdivided. During the past five years, the orchard development has been very rapid, there being an average of 1,000,000 trees planted annually. Varieties in the orchards planted by the pioneers were principally the hardy sorts, as hardiness was considered to be the necessary element of the tree. This filled the valley with

apples of an inferior quality, but later developments demonstrated the fact that the conditions were favorable for the growing of higher grade fruit, hence the young orchards are planted with up-to-date, standard varieties.

Some varieties of grapes are proving very satisfactory in the state, and the time is near at hand when Montana grapes will occupy a prominent place in her list of fruits.

Although there is none of the nut-bearing trees indigenous to Montana, yet black walnut, butternuts, English walnuts, chestnuts, filberts and hickories thrive when planted in the state, and where sufficiently old they are producing annual crops of nuts.

Small-fruits are grown in all parts of the state with unparalleled success. Every ranch home in the state can be supplied with small-fruits from the home patch, if the proper varieties are selected and given good care.

Great success has been achieved in the growing of vegetables wherever it has been tried. In all of the newly settled parts of the state, as well as in the older developed valleys, wherever locations are carefully selected for the orchard and garden, fruits and vegetables can be grown to supply the home needs, and in the valleys especially adapted in the different parts of the state, commercial enterprises are profitable.

The growing of the smaller vegetables, such as peas, beans, and the like, is being stimulated by the establishment of canning factories. A very large one, located at Bass Spur in the Bitter Root Valley, is handling peas, beans, pumpkins, squash, tomatoes, and all of the different fruits. The cantaloupe and watermelon industry is becoming a prominent factor in the Yellowstone Valley near Billings. Cucumber-growing for pickles is a leading branch of the vegetable-growing in the Yellowstone Valley. A pickle factory at Billings consumes the product from a large acreage.

The growing of vegetable seed is becoming one of the leading industries in some parts of the state. Seed pea-growing has been especially remunerative in valleys where tried. The growing of alfalfa seed is a leading enterprise in many of the dry-land sections in the eastern part of the state. Montana alfalfa seed always stands foremost in the markets.

A rapidly growing demand for the winter flowers to supply the Pacific coast trade has induced the leading florists in the important cities to increase their output until it has become one of the leading branches of the florists' trade. New plants have been built for this purpose and many of the older ones have been enlarged.

There is a great increase in the demand for ornamentals in the cities and towns, and also in the country districts. Some of the nurserymen are catering to this branch of trade almost exclusively, only growing fruit-trees sufficient to supply local demands.

Bees and honey are profitable side issues with many farmers and fruit-growers. Good honey always finds a ready market and the quality of Montana honey is unsurpassed. In the extensive alfalfa and orchard sections, bees find extensive range for ideal feeding-grounds. Good prices are always paid for Montana comb or strained honey.

Among those influential in developing Montana horticulture may be mentioned Daniel Bandmann of Missoula, one of the early planters of McIntosh Red apples, and M. H. Pierce of Plains, one of the pioneer planters of the commercial orchard in Montana.

Public-service agencies for horticulture.

The Land-Grant college of Montana is located at Bozeman, and was established in 1893. There are two members of the horticultural staff.

The Experiment Station is located at Bozeman and there is also a sub-station at Victor in the Bitter Root Valley. About thirty horticultural bulletins have been issued.

The Extension Department of the College holds schools in different sections of the state. There is no horticulture taught in the public schools.

The inspection services come under the direction of the State Board of Horticulture, through the State Horticulturist. The fruit sections are divided into districts and an inspector is provided for each district.

Statistics (Thirteenth Census).

The approximate land area of Montana in 1910 was 93,568,640 acres, including 115,840 acres in Yellowstone National Park. The land in farms was 13,545,603 acres, or 14.5 per cent of the land area. Of these 13,545,603 acres in farms, 3,640,309 were improved; 595,870 were woodland; and 9,309,424 were other unimproved land in farms. The total number of farms in 1910 was 26,214. The average acreage to a farm was 516.7. [The total area is 146,997 square miles.]

The leading agricultural crops are hay and forage, and cereals. The acreage devoted to hay and forage increased from \$75,712 in 1899 to 1,135,376 in 1909, when the value of the production was \$12,344,606, which was 41.5 per cent of the total value of all crops. The acreage of cereals increased from 254,231 in 1899 to 635,807 in 1909, when the value of the cereals produced was \$12,251,345, or 41.2 per cent of the total value of crops produced. Sugar crops increased in acreage from 2 in 1899 to 8,821 in 1909, when the value of the products was \$547,178. The value of forest products in farms in 1909 was \$541,800, as compared with \$176,134 in 1899.

Horticultural crops produced are fruits, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of fruits produced in 1909 was \$609,095, as compared with \$59,587 in 1899. Small-fruits increased in acreage from 554 in 1899 to 562 in 1909, when the production was 766,791 quarts, valued at \$86,586. In 1909 the total acreage of potatoes and other vegetables was 28,010, and their value \$2,227,736. Excluding potatoes, the acreage of vegetables increased from 4,272 in 1899 to 7,300 in 1909, when the value of the production was \$928,906. Flowers and plants and nursery products increased from 79 acres in 1899 to 361 acres in 1909, when the value of their products was \$279,028.

The total quantity of orchard-fruits produced in 1909 was 591,088 bushels, valued at \$609,078. Apples contributed more than 95 per cent of this quantity, the production being 567,054 bushels, valued at \$566,938. The number of apple trees of bearing age in 1910 was 696,753; those not of bearing age, 1,308,066. The cherry trees of bearing age in 1910 numbered 19,938; those not of bearing age, 24,237. The production in 1909 was 7,497 bushels, valued at \$17,985. The pear trees of bearing age in 1910 numbered 10,297; those not of bearing age, 12,806. The production was 7,543 bushels, valued at \$12,008. Plums and prunes of bearing age in 1910 numbered 21,140; those not of bearing age 15,001; and the production in 1909 was 8,777 bushels, valued at \$11,642. Peach and nectarine trees of bearing age in 1910 numbered 538; those not of bearing age, 3,386; and the production in 1909 was 128 bushels, valued at \$235. Apricots were also produced in 1909 to the value of \$269.

Grapes are of comparatively no importance, as are also nuts, there being a production of grapes valued at only \$17, while no value was placed upon the small quantity of nuts produced.

Strawberries are by far the most important of the small-fruits, with raspberries and loganberries second in importance and currants, third. The acreage devoted to the strawberry decreased from 281 in 1899 to 265 in 1909, when the production was 406,038 quarts, valued at \$46,870. The acreage of raspberries and loganberries increased from 80 in 1899 to 113 in 1909, when the production was 165,473 quarts, valued at \$19,732. Currants decreased in acreage from 120 in 1899 to 115 in 1909, when the production was 123,031 quarts, valued at \$12,195. There were also produced 36,321 quarts of blackberries and dewberries, valued at \$4,020 and 35,896 quarts of gooseberries, valued at \$3,765.

The acreage devoted to potatoes increased from 9,613 in 1899 to 20,710 in 1909, when the production was 3,240,696 bushels, valued at \$1,298,830. The more important of the other vegetables produced in 1909 were: 359 acres of cabbage, valued at \$56,210; 119 acres of onions, valued at \$15,310; 164 acres of sweet corn, valued at \$13,692; 11 acres of celery, valued at \$4,800; 34 acres of rutabagas, valued at \$3,960; and 69 acres of turnips, valued at \$3,858. Vegetables of less importance produced in 1909 were green beans, beets, cantaloupes and muskmelons, carrots, cauliflower, horseradish, tomatoes, and watermelons.

The acreage devoted to the production of flowers and plants increased from 17 in 1899 to 20 in 1909. The total area under glass was 308,939 square feet, of which 289,024 were covered by greenhouses and 19,915 by sashes and frames. The value of the flowers and plants produced in 1909 was \$104,601, as compared with \$33,630 in 1899.

The acreage devoted to nursery products increased from 62 in 1899 to 341 in 1909. The value of the nursery products in 1909 was \$174,427 as compared with \$17,825 in 1899.

M. L. DEAN.

Idaho.

The state of Idaho (Fig. 2525), lying west of the Rocky Mountains, is of vast extent and wide diversity of topography. It has a range north and south of approximately 485 miles, extending from the 42nd to the 49th parallels of latitude. Its breadth east and west, at its widest point, is about 310 miles. Taking the state as a whole, the altitude ranges from that of central and northern Indiana to more than 5,000 feet above the highest peaks of the Appalachian system.

Some of the salient features of Idaho are its sage-brush plains, high snow-capped mountains and timbered plateaus. Along the eastern border of the state lie the Cœur d'Alene, Bitter Root, Cabinet and many other ranges of mountains. The Owyhee Mountains lie in the southwest corner and their lateral spurs extend almost to the Snake River. The native vegetation of the whole of the southern part of the state, as far north as the middle of Washington County, is sage-brush. This entire area is a vast agricultural region, having at the present time 1,843,039 acres of irrigated lands. South Idaho is an arid region, the rainfall for that part of the state being from 8 to 15 inches. The timbered plateau extends over most of the northern and central parts of the state. The principal trees found in this area are yellow pine, red fir, and white pine. The northern part of the state is humid, the annual precipitation varying from 20 to 25 inches. The agricultural lands lie mostly near the western border. The state is entirely drained by the Snake River and other tributaries of the Columbia.

The development of the fruit industry in Idaho is interesting. In the year 1836, H. H. Spaulding started an orchard on the Clearwater River, a few miles above Lewiston, at a place now known as Joseph. Later plantings were made in the southern part of the state in the year 1862. Two small orchards were set out on the Snake River near the Brown Lee country. Small plantings were also made on the Payette River in 1863 and near Boise in 1865. From these small plantings, the fruit industry has developed until now there are over 120,000 acres planted to orchards.

Owing to differences in altitude and climatic conditions, the state may be divided horticulturally into several distinct districts.

The North Idaho or Panhandle district includes the

timbered territory of northern Idaho and especially the country around Coeur d'Alene, Hayden Lake, Pend Oreille Lake, Sandpoint, Bonners Ferry, Clarks Fork, Rathdrum, and Post-Falls. It includes all of Bonner County and parts of Kootenai, Shoshone, Latah, Clearwater and Idaho counties. It is a large district and there is considerable variation in the conditions in different parts of it.

The soils of the northern part of the state vary in texture from silt loams to sandy loams and in color from red to black. The climate is mild in summer and not severe in winter. The elevation varies from 1,500 to 2,500 feet. The annual precipitation is from 20

ton. As conditions are very similar on the "Camas prairie" which lies in Idaho, Lewis, Clearwater, and Nez Perce counties, it is also included in the Palouse district. The larger plantings of fruit on "Camas prairie" are found in the vicinity of the towns of Grangeville, Cottonwood, and Nez Perce.

Irrigation is not necessary in this district, the rainfall being from 20 to 25 inches, which is sufficient to grow crops successfully, although a good dust-mulch is essential in order to obtain size of fruit. The deep, friable soils are of basaltic formation, very fine in texture, and hold moisture remarkably well. The elevation varies from 2,000 to 3,500 feet.

The proper choice of a site is very essential to successful orcharding. The orchard should be located on a slope and the lower side should be at a somewhat greater elevation than the bottom of the valley. This insures air- as well as good soil-drainage. As cold air settles to the lower levels, low places are subject to frost and for that reason low-lying basins or pockets should be avoided for orchard purposes.

Experiments have shown that greater color may be secured on apples in this district by summer pruning.

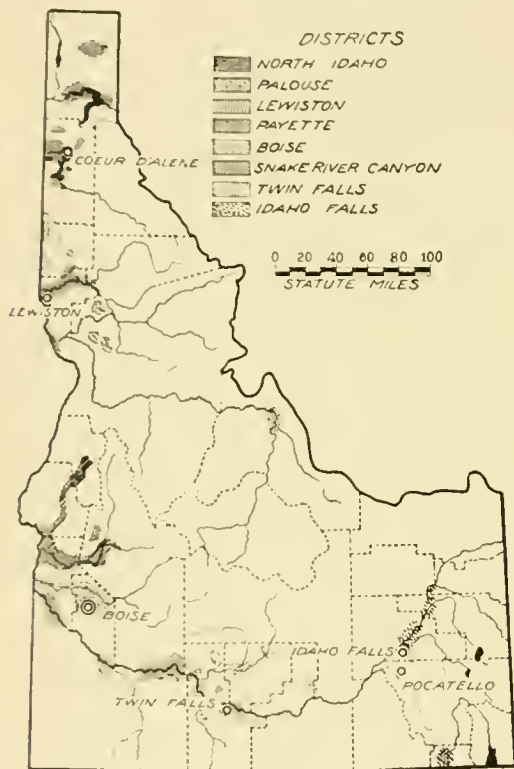
Pear-growing is rapidly gaining prominence in certain parts of the Palouse district. All sweet cherries do exceptionally well. The Bing is the leader, although the Royal Ann and Lambert are excellent. The sour cherries also find here soil and climate congenial to their growth. The Italian prune does not attain the size which it reaches in some of the the irrigated sections of the state, but the quality is excellent. Peaches are nearly always killed by frost and practically none is raised in the district; the same is true of grapes.

The strawberry is one of the most popular fruits grown. It thrives well in practically all parts of the district. The Clarks Seedling is a favorite on account of its superior shipping qualities, its flavor and its yield. Very few loganberries are raised although they apparently do very well. All other small-fruits grow well when cared for in a proper manner.

The Lewiston district includes the territory around the town of Lewiston in the Lewiston Valley. It extends up the Clearwater Valley to Stites; up the Potlatch Creek Valley to Kendrick; and south from Lewiston along the Snake River. The average elevation is low. It varies from 700 feet to about 2,000 feet at the upper end of the Potlatch Creek Valley. The annual precipitation ranges from 12 to 20 inches. Irrigation is practised in the Lewiston orchards as well as in parts of the Clearwater and Snake River valleys. Practically all kinds of fruits of excellent quality are raised here. In a few favored localities, European grapes, such as Flame Tokay, Muscat, and the like are grown successfully. A large percentage of the fruit in this district is grown on a bench about 3 miles southeast of Lewiston at an approximate elevation of 1,500 feet, known as the "Lewiston orchards." In these tracts there are about 6,000 acres. A few varieties of fruit are grown in this locality that do not do well in other parts of the state, among them being the Spitzenberg and Yellow Newton varieties of apples.

The Payette district includes the territory along the Payette River from its mouth to the Horseshoe Bend and Brown Lee country; along the Snake River from Weiser to Payette; and along the Weiser River from Weiser to the Council Valley. A large percentage of the fruit is planted around the towns of Payette, Fruitland, New Plymouth, Emmett, Woods Spur, Jonathan and Weiser. This is the largest fruit district of Idaho, calculated on the basis of the acreage planted to fruit. The soils are volcanic ash and vary in texture from light sandy loams on the uplands to heavy dark loams in the valleys. The annual precipitation ranges from 10 to 15 inches. Irrigation is necessary.

The Council Valley section is located along the upper Weiser and Council rivers. Its elevation varies from



2525. Idaho, with most important horticultural parts.

to 25 inches and is sufficient to mature horticultural crops although irrigation is practised in several localities.

While a large number of varieties of apples are grown in this district, the Wagener is apparently the leader. Northern Idaho is, however, much more of a natural pear than apple district. The growers have less trouble with blight than in some other sections of the state. This is not a peach nor a grape district and practically none of these fruits is grown. In favored localities, a few early peaches, such as Hale Early, and early grapes such as Moore Early, might be grown. All sour cherries do well, and in parts of the district excellent sweet cherries are raised. All the other small- and tree-fruits are grown successfully. Some growers report that loganberries cannot be raised, while others state that they do very well.

The local conditions, such as soil, air-drainage, elevation and slope are important considerations in the establishment of an orchard in this district.

The Palouse district includes all of the typical rolling wheat-growing region, known as the "Palouse country." The commercial orchards are mostly located around the towns of Viola, Moscow, Potlatch, Genesee and Prince-

3,000 to 4,000 feet. The protection is very good and fruit of fine quality is grown. Approximately 3,000 acres are in fruit at the present time.

Almost all kinds of fruit of excellent quality are grown in the Payette district. However, at the present time, apples and prunes are the leaders in importance from a commercial standpoint. Blackcap raspberries are also of some importance commercially. Almost all kinds of apples grow well. The Arkansas Black is one of the best money-makers, with the Rome Beauty a close second. The acreage in Jonathans is large.

Pears are not grown extensively at the present time in the Payette Valley. Very fine peaches are grown, also all kinds of cherries, Italian prunes, plums and practically all of the small-fruits and American grapes.

The "Emmett bench," being farther up the Payette River valley, presents conditions slightly different. The protection is better and there is a longer growing season. In this section, all American varieties of grapes mature well and are of excellent quality. In favored situations, the European varieties, especially the Malaga, Sweetwater, Cornichon, Muscat and Thompson Seedless, are grown. The Tokay is also grown, although it does not always mature properly.

The Boise Valley district includes the entire Boise Valley with Boise at one end and Parma at the other. It is about 35 miles long and varies in width from 2 to 10 miles. While fruit is raised in the entire valley, most of the commercial orchards are found in the country around the towns of Boise, Eagle and Star, Parma, Colliester and Middleton on the north side of the River, and Meridian, Nampa, Caldwell and Roswell on the south side. There are approximately 25,000 acres and it is the second largest fruit district in Idaho. While many varieties of apples do excellently in this district, the Rome, according to many of the growers, is the most profitable. However, the growers are almost unanimous in agreeing that the Italian prune is the leading money-maker in the Boise Valley at the present time. The sloping ground nearer the mountain ranges is best adapted to the growing of peaches, sweet cherries and grapes commercially. In the lower elevations, there is great danger of frost. Sour cherries succeed well in the level, open country. Berries of all kinds succeed well and there is seldom a failure, although strawberries are sometimes affected by a late spring frost. The soils of the Boise Valley are very rich. The elevation varies from 2,000 to 3,000 feet. The annual precipitation is from 10 to 15 inches. Irrigation is depended upon to mature crops grown in the valley.

The Snake River Cañon district consists of: (a) The Homedale section, which includes Indian Cove, Central Cove, Sunnyside, Fargo and Peaceful valleys. All of these are coves along the Snake River. This section is well adapted to fruit as the climate is excellent for fruit-growing purposes. However, trees should not be planted on the adobe land on the floor of the river valley. There are about 2,000 acres in this section, which are distributed along the Snake River for 30 miles. (b) The Upper Snake River Cañon section which consists of Grand View, Medbury Valley, Glens Ferry, King Hill, Swiss Valley, Hagerman Valley, Crystal Springs, Niagara Springs and Blue Lakes. This is approximately 100 miles long and is a narrow cañon varying in width from 1 to 4 miles. The fruit is planted in spots.

The entire district is located directly along the Snake River. The hills or cañon walls on each side of the river afford an excellent protection, although there is a wide variation. At Blue Lakes, the cañon walls of the river are very steep and about 800 feet high, while in the Homedale section, the valley is much wider and the hills not nearly so abrupt nor high. This entire area has a mild climate and long growing season, well adapted to the growing of fruits, and there are localities where even tender fruits, such as European grapes, are

grown successfully. Apples thrive well and are grown commercially. Peaches, sweet cherries, grapes, and the like, have the advantage of a good local market, due largely to the fact that they ripen earlier than those grown outside of the cañon district. Sour cherries are excellent and sweet varieties succeed well. Prunes, plums, strawberries and all of the small-fruits grow well and produce abundantly.

The Twin Falls district includes: (a) The territory known as the North Side Twin Falls section and the surrounding country where the conditions are similar, especially the vicinity around the towns of Tieska, Bliss, Jerome, Gooding, Wendell, Shoshone and Richfield. In this entire section, there are approximately 6,000 acres in fruit. (b) The South Side Twin Falls section, especially the area surrounding the towns of Hansen, Kimberly, Twin Falls, Filer, Buhl, Minidoka, and Burley. Minidoka and Burley are located on the Minidoka project and at the present time very little fruit is grown in this vicinity. In this section there are about 19,000 acres in fruit. (c) The Salmon Tract is a flat, irrigated country located to the east of Salmon River and watered by the Salmon River and Deep Creek. There are approximately 3,000 acres in fruit.

The average elevation of this district is rather high, varying from 3,500 to 4,500 feet. The soil is a clay loam and is excellent for the production of fruit. Throughout the entire district, irrigation must be practised in order to produce crops. Peaches and American grapes are grown to a limited extent, although these are much later than those grown in the cañon district nearby. Few sweet cherries are grown. Apples are the leading commercial fruit, although sour cherries, prunes, plums and all the small-fruits will grow to perfection. Occasionally a late frost affects the berries. This district is still very young from a horticultural standpoint as most of the land was first irrigated about ten years ago.

The Blackfoot and Idaho Falls district consists of a strip of land running from Blackfoot through Idaho Falls and on to St. Anthony, being approximately 80 miles long and 30 miles wide. The average elevation is about 4,700 feet. There is a gradual rise in elevation from Blackfoot to St. Anthony of about 13 feet to the mile. In general, the soil is excellent. The area planted to fruit in this district is small compared with some of the other fruit districts of Idaho. There are some favored localities where commercial plantings have been made. Sour cherries, dewberries, blackberries and blackcap raspberries are grown on a small scale. Prunes and plums succeed well while strawberries, red raspberries, gooseberries and currants grow to perfection.

Public-service agencies for horticulture.

The University of Idaho was established in 1889, by an act of the Territorial Legislature, at Moscow. The College of Agriculture was established in 1891, by order of the Board of Regents, as one of the colleges of the University. The horticultural staff consists of four members.

The Experiment Station is a regularly constituted department of the University, and was also established in 1891. The gardens and orchards, consisting of 45 acres, give ample room for all research work, which is being carried on at the present time. Since the establishment of the Experiment Station, twenty-seven bulletins and circulars have been published, having a direct bearing upon horticultural subjects.

The Extension Department of the University was established in 1912, with headquarters at Boise.

The Horticultural laws of the state of Idaho provide for a State Horticultural Inspector, whose jurisdiction shall extend throughout the state. To render more efficient service, the state has been divided into fourteen districts, a deputy horticultural inspector being placed in charge of each district.

Statistics (Thirteenth Census).

The approximate land area of Idaho is 53,346,560 acres, which includes 32,640 acres in Yellowstone National Park. Of the total land area, 5,283,604 acres or 9.9 per cent is in farms, of which 52.6 per cent or 2,778,740 acres are improved; 584,556 acres are in woodland; and 1,920,308 acres are classified as other unimproved land in farms. There are in the state 30,807 farms, the average acreage of which is 171.5 acres. [The total area is 83,888 square miles.]

The leading agricultural crops are cereals, hay and forage, sugar crops, and forest products of the farm. The cereals in 1909 occupied 847,138 acres as compared with 369,788 acres in 1899. This showed an increase in acreage of 129.1 per cent for the period. The value of the cereals in 1909 was \$16,026,676 or 46.4 per cent of the total value of all crops. Hay and forage increased in acreage 42.7 per cent for the same period, the acreage being 513,656 in 1899 and 732,886 in 1909. The value of the hay and forage for 1909 was \$12,099,963, or 35.2 per cent of the total value of all crops. The percentage of improved land occupied by the cereals and hay and forage was 30.5 and 26.4, respectively, in 1909. Sugar crops, in 1909, occupied 15,630 acres as compared with 21 acres in 1899 and the value of the sugar products in 1909 was \$815,068. The value of the forest products of the farms in 1909 was \$1,280,512, as compared with \$315,821 in 1899.

Horticultural crops grown are fruits and nuts, vegetables including potatoes, small-fruits, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$882,526, as compared with \$371,273 in 1899. Small-fruits increased in acreage from 957 in 1899 to 1,673 in 1909, when the value of their products was \$201,525. Vegetables lead in value of the horticultural crops grown in Idaho. In 1909 the total acreage of potatoes and all other vegetables was 38,371 and their value \$2,591,199. Flowers and plants and nursery products increased in acreage from 120 in 1899 to 548 in 1909, when their value was \$186,518.

The total quantity of orchard-fruits produced in 1909 was 924,223 bushels, valued at \$863,516. Apples contributed more than two-thirds of this quantity; plums and prunes most of the remainder. In 1910, there were in Idaho 1,005,668 apple trees of bearing age and 1,539,896 apple trees not of bearing age. The production in 1909 was 659,959 bushels, valued at \$610,504. Plum and prune trees of bearing age in 1910 numbered 302,855; those not of bearing age, 98,017. The production in 1909 was 179,027 bushels, valued at \$132,804. Peaches and nectarines are of interest for while the number of trees of bearing age numbered only 73,080 in 1910, those not of bearing age numbered 212,995. The production in 1909 was 18,734 bushels, valued at \$28,149. In 1909 the production of pears was 42,649 bushels, valued at \$48,045; that of cherries 22,609 bushels, valued at \$41,766; and that of apricots 1,108 bushels, valued at \$2,034. The production of quinces and mulberries was of little importance.

The grape-vines of bearing age in 1910 numbered 68,269; those not of bearing age, 124,806. The production in 1909 was 604,227 pounds, valued at \$18,814.

Nuts are of little or no importance in Idaho. The nut trees of all varieties in 1910 of bearing age numbered only 1,379 and those not of bearing age, 3,495. The production in 1909 was 3,328 pounds, valued at \$196.

Strawberries are by far the most important of the small-fruits raised in Idaho, with raspberries and loganberries ranking next. The acreage of strawberries increased from 239 in 1899 to 698 in 1909, when the production was 953,723 quarts, valued at \$92,904; the acreage of raspberries and loganberries was 496 in 1909 and the production was 575,209 quarts, valued at \$59,854. Other small-fruits produced were: 249,984 quarts of blackberries and dewberries, valued at

\$24,688; 161,230 quarts of currants, valued at \$13,760; and 130,987 quarts of gooseberries, valued at \$10,317.

Of the vegetables, the potato was by far the most important. The acreage increased from 9,313 in 1899 to 28,311 in 1909, an increase of 204.3 per cent. The value of the 4,710,262 bushels produced in 1909 was \$1,583,447. The most important of the other vegetables grown in 1909 were: 289 acres of cabbage, valued at \$43,517; 213 acres of cantaloupes and muskmelons, valued at \$15,407; 165 acres of watermelons, valued at \$15,016; 85 acres of onions, valued at \$17,065; and 42 acres of tomatoes, valued \$8,840. In 1912, beans were valued at \$210,000 and peas at \$725,000. There were also grown in smaller quantities, carrots, celery, sweet corn, cucumbers, and turnips.

The acreage devoted to flowers and plants increased from 5 in 1899 to 18 in 1909. The area covered by glass was 59,477 square feet, of which 58,727 were covered by greenhouses and 750 by sashes and frames. The value of the flowers and plants produced in 1909 was \$43,314, as compared with \$2,805 in 1899.

The growing of nursery products was of more importance than the growing of flowers and plants. The acreage occupied by nursery establishments increased from 115 in 1899 to 530 in 1909, an increase of 360.9 per cent. The value of the nursery products in 1909 was \$143,234, as compared with \$38,431, the value in 1899.

C. C. VINCENT

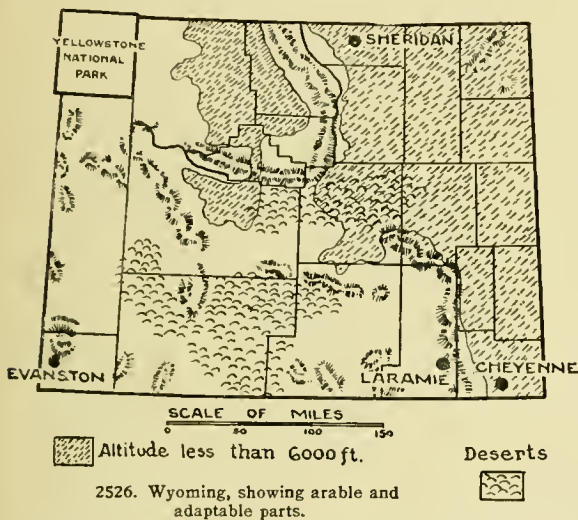
Wyoming.

The agricultural land in Wyoming (Fig. 2526) is at a higher average altitude than that in any other state. Broadly speaking, the range is from about 3,500 feet to twice that height. In a few protected valleys a limited agriculture is practised at even greater elevations, but most of the recognized districts lie below 6,000 feet. Taking the state as a whole, more than one-half the total area is above 6,000 feet. This includes the high mountain ranges which, as a rule, are forest-covered and included in the National Reservations. The conservation policy has nowhere been better exemplified than in Wyoming, where its beneficent results are seen not only in the husbanding of the timber resources, but also and more particularly in the equalized water-flow in the streams, and the larger, safer and more equitable use of the forests as grazing-lands. Perennial streams flow in every direction from the mountains and furnish enough water for the irrigation of very extensive tracts. In the course of time, when provision shall have been made for the impounding of all of the flood-waters, the areas thus reclaimed will be much greater than at present. It has been estimated that there is a sufficient water-supply to reclaim about 12,000,000 acres, only about one-fourth of which is now under canals.

Wyoming extends some 355 miles from east to west, and 276 from north to south, embracing something more than 97,000 square miles. It lies in the very heart of the Rocky Mountains, three great river systems, the Missouri, the Columbia, and the Colorado arising within its boundaries. As would be expected, there is great diversity of climate, soil and vegetation (indigenous and introduced). There are protected valleys, bench-lands, and fertile foothills; semi-arid plains, bleak plateaus, and saline deserts; forested slopes and snow-capped mountains. These are further diversified by marsh-lands in the valleys and occasional alkali ponds on the plains, and splendid fresh-water lakes in the mountains, thus preventing even a semblance of monotony in the geographical configuration. A physical environment so complicated readily accounts for the fact that Wyoming's native flora is far richer in the number of species than any of the other states, except possibly two or three of the other and larger mountainous ones, notably California and Colorado. The mean annual temperature varies from less than 40°F. to about 50°.

The rainfall is as little as 4 to 6 inches per annum in the Red Desert and reaches a maximum of 30 inches or more on the higher mountains. The average for the irrigated agricultural districts is probably less than 12 inches, while in certain localities where "dry-farm" methods are proving successful it may be as much as a third more. In the eastern part of the state, particularly in Crook, Weston, Niobrara, Goshen, and Laramie counties, many new communities have been established in the last decade where general farming is practised, the natural rainfall being sufficient in average years to grow profitable crops if the water be wisely conserved by the new approved methods of tillage.

The last decade has seen also the breaking up of many of the great stock ranches and ranges into smaller holdings. The marked increase in the state's population is due primarily to the settlement of some of the agricultural lands by farmers from the older



commonwealths. Wyoming has therefore entered upon a new era,—a time when it will be seen that a diversified agriculture is the basis of an enduring prosperity. The natural conditions make the live-stock business of paramount importance. The soil is cultivated principally, in most parts of the state, to increase the amount of stock-food, and little intensive farming has been inaugurated. Some of the ranches that extend for miles along the streams have not yet known the use of a plow except in the construction of the ditches to irrigate the native meadows. This condition of things is, however, rapidly passing. The large holdings are being broken up into irrigated farms, thus supporting scores of families instead of a few non-resident owners of the incorporated live-stock companies. Progress in the direction of home-building has also been promoted by the great government projects in conservation and irrigation, as for example the Pathfinder and the Shoshone dams, the canals from which are reclaiming hundreds of thousands of acres. The coming in of the sugar-beet industry, with its factories, is further adding to the population.

The state as a whole will not reach great commercial importance because of its horticultural products, but certain rather extensive districts, primarily parts of Big Horn, Fremont, Natrona, Goshen, Sheridan, and Washakie counties, have lands that will be worth more as apple and plum lands than for any other purpose. Some of the hardy fruits have been grown in every county in the state and in most of them there are many locations in which astonishingly satisfactory results have been attained.

Commercial orchards are being established in a few localities, some of which are now coming into bearing. They vary in size from 10 acres to even 100 acres or more. The very remarkable activity, however, along horticultural lines has expended itself, in large part, upon the home orchard. During the last few years, the growing of fruit for the family table has been attempted for the first time in Wyoming, upon thousands of homesteads. New settlers from the states to the eastward come with definite notions of what they will attempt and they are meeting with a substantial degree of success both upon the irrigated and the "dry farms."

The agricultural land along the water-courses naturally were the first areas to be brought under cultivation, since the canals necessary to bring the water to the soils could be easily and cheaply constructed. The bench areas, or uplands, however, have better drainage both for water and air, and are more likely to be free from injurious late and early frosts. These are now being brought under cultivation and are well adapted for fruit-growing, though it should be said they are no better than certain of the bottom lands and foothills locations. Warm, sandy loams in protected places, whether on the stream bank or in the valleys among the foothills, may be depended upon. On the open plains and table-lands, in most parts of the state, it is necessary to provide windbreaks to protect both tree and fruit against stiff storms and desiccating winds.

The great diversity of soil and climate and the differing degree of protection, gives a gradually diminishing list of fruits that are hardy and adapted. Beginning with the most favored localities, tender vegetables, like tomatoes, melons, cantaloupes and sweet potatoes, are grown successfully on a commercial scale. Under these conditions all the hardy fruits that will mature in a growing season of 150 to 180 days are standard. As the lands lie at successively higher elevations and with less favorable exposures or with less natural or artificial protection, the reliable varieties shade down to a few of the so-called "iron-clad" ones. At 6,000 to 8,000 feet, light frosts occasionally occur, even in July and August. It is, however, a matter of common observation that with increasing altitude the effect of frost is less and less marked, so that tender vegetation which goes down under 1° or 2° of frost at sea-level, at 8,000 or 9,000 feet will stand untouched when night temperatures are several degrees below the freezing-point. Potatoes, in the mountain valleys, will bend under the dense hoar-frost night after night without injury. Another physiological phenomenon is borne out by common observation, viz., that plants in the high altitudes "learn to hurry." The identical species that in the lower altitudes take the whole growing season will reach maturity in the successively fewer growing days of the season at higher levels.

During the past few years, the State Board of Horticulture, the State Horticultural Society, and the Superintendent of the Horticultural Experimental Farm have cooperated in compiling a list of the fruits that may be relied upon. This tentative list stands as below. It is to be remembered that Wyoming is, horticulturally speaking, very young and therefore further observation and experiment will no doubt add to and subtract from this.

For altitudes above 6,000 feet.—Apples—Transparent, Duchess, Tetofsky, Wealthy. Crabs—Siberian, Transcendent, Florence. Cherries—Compass cherries only. Plums—Sapa, Opata, DeSoto. Currants—Red Dutch, Fay's Prolific, Champion. Gooseberries—Houghton, Industry. Strawberries—Dunlap, Crescent.

For altitudes above 4,500 and under 6,000 feet.—Apples, fall—Transparent, Duchess, Tetofsky; late fall and winter—Wealthy, Longfield, Patten. Crabs—Transcendent, Whitney, Florence. Pears—Douglas, Idaho, Flemish. Cherries—Compass, Richmond.

Plums—Cheney, Wolf, Hanska, Opata. Raspberries—Sunbeam, King, Turner. Currants—Victoria, Red Dutch, White Grape. Gooseberries—Houghton, Industry, Carrie. Strawberries—Dunlap, Bederwood, Warfield, Jessie. Grapes—Beta.

For altitudes below 4,500 feet.—Apples, summer and fall—Transparent, Duchess, Tetofsky, Charlamoff; late fall and winter—Wealthy, Wolf River, Northwestern Greening, Windsor, Fameuse, McIntosh, Banana, Jonathan. Crabs—Transcendent, Whitney, Bailey. Pears—Douglas, Idaho, Flemish. Cherries—Morello, Richmond, Suda, Etapa, Compass. Plums—Wolf, Cheney, Burbank, DeSoto, Sapa, Opata, Hanska. Raspberries—King, Turner, Herbert, Ranere. Currants—Victoria, Red Dutch, White Grape, Champion. Gooseberries—Houghton, Industry, Carrie. Strawberries—Dunlap, Bederwood, Warfield, Gandy. Grapes—Beta, Concord (with protection). Dewberries—Lucretia (with protection).

The state maintains an experimental fruit farm at Lander. The altitude there is about 5,500 feet,—about midway between the lowest and the highest points at which fruit-growing is attempted.

The number of plantings at that farm is 2,420 trees, distributed as follows: Apples, 160 varieties, of which forty-eight have fruited; crabs, twenty varieties, all of which have fruited; pears, fourteen varieties, five of which have fruited; plums, twenty-four varieties, sixteen of which have fruited; cherries, fifteen varieties, five of which have fruited; prunes, two varieties, one of which has fruited; apricots, two varieties, one of which has fruited.

Based upon the results thus far attained, the following list of apples is a suggestion from which planters may select, the arrangement being in the order of hardiness or adaptability to Wyoming conditions: Summer varieties—Transparent, Charlamoff, Linfield, Duchess, Whitney No. 20, Enormous, Utter, Astrachan, Okabena, Hutchins, Hibernial, Patten Greening and Grundy; winter varieties—Wealthy, Peter, Gideon, Fameuse, McIntosh, Northwestern Greening, Pewaukee, Scott, Windsor, York, McMahon, Wolf, Gano.

Trucking is developing satisfactorily in the vicinity of several of the larger towns and cities. Everything, however, is for the home market exclusively, no shipments being made out of the state. Most of the vegetables grown are delivered fresh and direct to the consumer from the producer's wagon. The principal items are lettuce, radishes, peas, beans, beets, carrots, parsnips, turnips, cabbage, cauliflower and, in fact, all of the usual hardy vegetables.

Public-service agencies for horticulture.

The schools for higher education are all located at Laramie. These include the State University, with its several schools and departments, the State Normal School, the Agricultural College, the University Extension Department, and the State Experiment Station. The University was opened in 1887 and the Agricultural College was an integral part of it from the beginning, but the work in agriculture was scarcely organized till 1891, when the Experiment Station was established. Since that time, courses in horticulture have been offered in connection with the work in other departments. At present, the Experimental Fruit Farm at Lander is coöperating closely with College and Station. Only a few horticultural bulletins have been issued, and these are now out of print.

The chief agency for promoting horticultural work in the state is the State Board of Horticulture, organized in 1905. The work of the Board of Horticulture may be divided into two categories: (1) the enforcement of quarantine regulations and the inspection of nursery stock and orchards; (2) the promotion of horticultural development along all lines by the dissemination of information that will help to safeguard the

industry, and of literature calculated to encourage the growers. Since the primary object has been to encourage production for home consumption along safe lines, the problems connected with packing and marketing are yet to be considered. The publications of the Board are appearing in two series, the biennial reports, of which five have been issued, and special bulletins.

A State Horticultural Society was organized in 1907. The Society maintains a horticultural department in the "Wyoming Farm Bulletin," a monthly journal issued by the Experiment Station.

Statistics (Thirteenth Census).

The approximate land area of Wyoming in 1910 was 62,460,160 acres. The land in farms was 13.7 per cent of the land area, or 8,543,010 acres. Of this land in farms, the improved land numbered 1,256,160 acres; the woodland, 252,152 acres; and other unimproved land in farms, 7,034,698 acres. The total number of farms in 1910 was 10,987, and the average number of acres to the farm was 777.6. [The total area of the state is 97,914 square miles.]

The leading agricultural crops of Wyoming are hay and forage, and cereals. Hay and forage increased in acreage from 380,769, in 1899, to 585,386 in 1909, when the production was valued at \$6,077,354, or 60.6 per cent of the total value of all crops. Cereals increased in acreage from 50,528, in 1899, to 186,947 in 1909, when the production was valued at \$2,744,502, or 27.4 per cent of the total value of all crops. The value of the forest products of the farms in 1909 was \$104,259, and in 1899, \$14,700.

Horticultural crops grown in Wyoming are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$39,806, as compared with \$1,470 in 1899. Small-fruits increased in acreage from 37, in 1899, to 106 in 1909, when the production was 96,883 quarts, valued at \$13,984. The total acreage of potatoes and other vegetables in 1909 was 11,266, and their value \$856,639. Excluding potatoes, the other vegetables increased in acreage from 1,431, in 1899, to 2,933 in 1909, when the production was valued at \$332,120. Flowers and plants and nursery products decreased in acreage from 7, in 1899, to 6 in 1909, when the products were valued at \$13,960.

The total quantity of orchard-fruits produced in 1909 was 18,586 bushels, valued at \$39,774. Apples contributed about 96 per cent of the quantity, the production of apples in 1909 being 17,836 bushels, valued at \$37,580. Apple trees of bearing age in 1910 numbered 27,773; those not of bearing age, 84,024. Plum and prune trees of bearing age in 1910 numbered 4,564; those not of bearing age, 7,475. The production of plums and prunes in 1909 was 659 bushels, valued at \$1,842. Cherry trees of bearing age in 1910 numbered 919; those not of bearing age, 4,025. The production of cherries in 1909 was 68 bushels, valued at \$251. The value of peaches and nectarines, pears, and apricots produced in 1909 was \$30, \$65, and \$6, respectively.

Grapes are of practically no importance, the production in 1909 being only 159 pounds, valued at \$32. The vines of bearing age in 1910 numbered 74; those not of bearing age, 1,147. The production of nuts is a negligible quantity.

The most important of the small-fruits grown in Wyoming in 1909 were currants, the acreage increasing from 8, in 1899, to 41 in 1909, when the production was 38,833 quarts, valued at \$4,378. Strawberries increased in acreage from 19, in 1899, to 24 in 1909, when the production was 20,895 quarts, valued at \$3,820. The production of blackberries and dewberries was 149 quarts, valued at \$29; that of raspberries and loganberries 15,213 quarts, valued at \$2,910; and that of gooseberries 21,513 quarts, valued at \$2,819.

Potatoes, the most important of the vegetables,

increased in acreage from 2,809, in 1899, to 8,333 in 1909, when the production was 932,162 bushels, valued at \$524,489. The more important of the other vegetables produced in 1909 were: 32 acres of cabbage, valued at \$6,289; 16 acres of onions, valued at \$3,260; 33 acres of turnips, valued at \$2,839; 44 acres of sweet corn, valued at \$1,815; 5 acres of tomatoes, valued at \$1,324; 9 acres of watermelons, valued at \$1,150; and 5 acres of cucumbers, valued at \$700. Small amounts of green beans, beets, carrots, celery, parsnips and pumpkins were also grown.

The land devoted to the use of flowers and plants increased from 5 acres, in 1899, to 6 acres in 1909. The area under glass in 1909 was 33,034 square feet, of which 31,584 were covered by greenhouses and 1,450 by sashes and frames. The value of the flowers and plants produced in 1909 was \$12,280, as compared with \$2,480 in 1899.

The value of nursery products in Wyoming for 1909 was \$1,680, as compared with \$215 in 1899.

AVEN NELSON.

Colorado.

The state of Colorado (Fig. 2527) includes the territory lying between the parallels 37° and 41° north latitude, and between the meridians 102° and 190° west longitude. Its surface is diversified by mountains, high tablelands, plains and valleys, with a range above ocean-level from 3,400 feet on the eastern border to over 14,000 feet in many of the higher peaks. It is traversed in a generally north and south direction by the great Rocky Mountain range, and is thus divided into two well-marked, though unequal, divisions. The main continental divide is supplemented by several well-defined ranges and by numerous mountain spurs, between which at altitudes ranging from 5,000 to 10,000 feet lie four large and several small parks and valleys, which were originally utilized as hay-ranches and for stock-ranges. At present, many of these mountain valleys are the most important farm lands of the state.

The tillable lands of the state are scattered more or less over the mountainous areas, as well as in the valleys of the Great Plains region. As the rainfall over the tillable area of Colorado is, for the most part, not above 13 to 15 inches, the larger part of the important agricultural production is by irrigation. Irrigation being a necessity, the lands useful for horticultural purposes are those which are reasonably level, either in the bottom-lands or on the mesas bordering the valleys, and which were at one time the bottom-lands along the streams. The first ditches were constructed cheaply and for the irrigation of bottom-lands only. Later, the idea of utilizing the higher mesas gave rise to great canal systems and made productive vast tracts of fertile soil both in the plains district and in the great basins of the mountain districts.

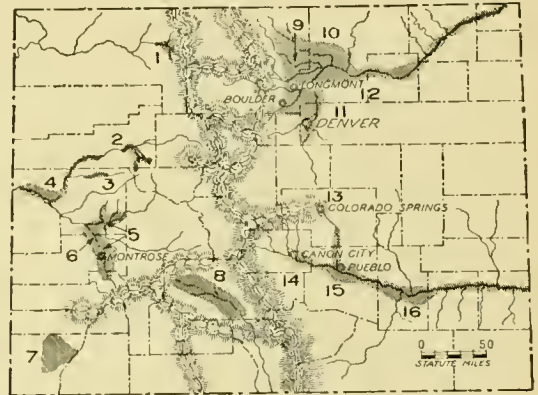
The main horticultural developments of Colorado are shown in the outline map, Fig. 2527, as follows: (1) strawberries; (2) potatoes; (3) dewberries; (4) orchard-fruits; (5) orchard-fruits and potatoes; (6) orchard-fruits, potatoes, onions; (7) apples, peaches; (8) potatoes; (9) apples, cherries, plums; (10) vegetables; (11) orchard-fruits; (12) raspberries; (13) greenhouse interests; (14, 15) fruit and vegetables; (16) apples, cherries, cantaloupes.

Owing to differences in latitude, altitude, and climatic conditions, the irrigable regions of the state are naturally separable into three divisions. These divisions are the Northern, which embraces the drainage basin of the South Platte and its tributaries, including Clear Creek, Boulder Creek, St. Vrain, Big and Little Thompson, and the Cache la Poudre. The Southern, or Southeastern, embraces the valleys of the Arkansas and its tributaries. The Western and Southwestern, which are more or less the same, embrace the valleys of the Grande and

its tributaries, the Uncompahgre and Gunnison in Mesa Delta and Montrose counties, and a great tract of land extending from Montrose around the spur of the San Juan Mountains, including the valleys of the San Miguel, Dolores, Mancos, La Plata, Animas, Florida, Pine, Rio Piedra, and the San Juan. These rivers drain the territory included in western Montrose, San Miguel, Dolores, Montezuma, La Plata, and Archuleta counties.

Other horticultural regions that are still largely undeveloped are the valleys of the Yampa or Bear River in northwestern Colorado and the White River in Rio Blanca County.

The apple is the leading fruit of the northern Colorado district. All the standard varieties are grown, though probably there are more Ben Davis trees than any other one variety. The cherry is the fruit of next importance and gives promise of becoming the leader, as the sour cherry is adapted to the conditions in northern Colorado and is more successfully grown without irrigation than any other fruit. The estimated acreage



2527. Colorado, with the parts developed in horticultural products.

of fruit in this district is 15,000 acres. Plums are more or less successfully grown in northern Colorado. Of these, the so-called native plums, or those varieties derived from *Prunus americana*, are most hardy and successful; many varieties of *Prunus domestica* are also grown.

In the Southern district the counties most prominent in fruit-culture are Fremont, which is at the base of the mountains in the Arkansas Valley, Pueblo, and Otero. Fremont County is one of the oldest and most important fruit districts of the state. What are supposed to be the oldest orchards of the state are located near Florence. In this district the apple is the most important fruit, followed by the cherry and plum, as in northern Colorado, and some peaches are grown in Otero County by protecting the trees during the winter. This protection is given by laying down the trees and covering with soil. The total area in fruit in the Southern district is approximately 25,000 acres.

In area devoted exclusively to fruit-growing and in importance of the product, the west slope easily leads other parts of the state. The largest solid areas devoted to fruit-growing are in Mesa, Delta, and Montrose counties in the valleys of the Grand, the Gunnison and Uncompahgre rivers. In these districts there is a great range of altitude, as fruit is grown as low as 4,500 feet at Grand Junction and at as high an altitude as 7,000 feet at Paonia and Cedaredge. In the narrow cañon at Palisade is one of the most remarkable peach districts of the country. Here in a cañon with walls on the north 2,000 feet high, peaches are grown at their best. The areas of fruit-production in these districts are rapidly increasing. The Gunnison Tunnel, an

irrigation project in the Uncompahgre Valley, furnishes water for 65,000 acres of land. Other ditches and projected canals in the Grand Valley are still more extensive, so that all told, the irrigated area of these three river basins approximates 300,000 acres.

The leading fruit of the west slope, as of other districts, is the apple. All varieties are grown, although the Jonathan, Rome Beauty, Winesap, Gano or Black Ben Davis, are coming to be the leading varieties. Pears are grown extensively in this district, except where the blight has destroyed the trees or made pear-growing unprofitable. Both the sweet and sour cherries are grown successfully. Of these, Montmorency and English Morello are the leaders among the sour cherries and Napoleon and Black Republican, of the sweet cherries. Peach-growing is largely limited to the Palsade and the so-called North Fork districts in the neighborhood of Paonia. The Elberta is at present the leading variety. Plums, both the American and European species, are grown extensively.

The fruit districts of the southwestern part of the state have not developed so rapidly as those of the western slope, largely owing to a lack of railroad facilities. Montezuma County has for several years been renowned for its excellence of fruit, and large plantings are being made there. The area adapted to fruit-growing in this Southwest district, which is from 100,000 to 200,000 acres, is as yet largely undeveloped and will require immense irrigation projects to bring it up to its possibilities of production. The area of the West and Southwest District approximates 65,000 acres planted to fruit.

Owing to the remarkable diversity in altitude, precipitation, soils, temperatures and exposures incident to its mountainous surface, Colorado has developed many peculiarities in horticultural crops. One of the most marked of these is the strawberry-growing industry of the Steam Boat Springs district of the northwestern part of the state. The climate is normally cool and the winter snowfall is heavy, lying on the ground from early fall till late spring. This gives perfect winter-protection to the plants. Their growth during the short, cool growing-season is remarkable. The fruit, which is abundant, large and of good quality, begins to ripen July 1 to 10 and continues well into August. At present there are only a few hundred acres of strawberries in the district, but the planting is rapidly increasing.

In the Plateau Valley, a few miles above Grand Junction, under climatic conditions somewhat similar to those of the Steam Boat Springs district, there has developed a rather unique industry in the way of dewberry-growing. There in the deep, rich, cool soils the dewberry attains a remarkable degree of excellence and productivity. Distance from railroad and the perishable nature of the fruit have prevented this crop from assuming extensive proportions, although the work has been profitable to a few individuals.

The red raspberry has been a profitable crop in various fruit districts of Colorado, particularly in the vicinity of Loveland. The strong, fertile soils, congenial climate, and moisture supplied by irrigation, combine to make a luxuriant growth of vines and heavy yields of fine fruit. In order to avoid the drying and killing effects of the arid winters, the practice is followed of laying down the canes and covering them with soil during the dormant season.

The potato is in point of value, with the possible exception of the apple, the most important of the horticultural crops of Colorado. There are many peculiarities in its adaptability to the conditions of soil and climate and the distribution of its production over the state. The climate and soil of the higher mountain valleys are exceptionally congenial, possibly because they are similar to its habitat in the high altitudes of the Andes Mountains of South America. One species, *Solanum Jamesii*, is native to the mountain plateaus of

Archuleta and La Plata counties in southern Colorado. Only a small part of the irrigated land of Colorado, however, is adapted to the growing of potatoes and but relatively small sections outside the high mountain valleys can produce potatoes at all successfully. For some reason, as yet not understood, the potato cannot be depended upon to make tubers on a large part of the best lands of the lower altitude districts. The more important potato-growing areas, in point of total production, are: the Greeley district, with a normal acreage of 35,000 to 40,000 acres, in the plains territory of northern Colorado; the Carbondale district at the junction of the Roaring Fork and the Crystal rivers in Garfield County; the Uncompahgre and North Fork valleys in Montrose and Delta counties; and the San Luis Valley, a mountain valley above 7,000 feet in altitude, comprising more than 3,000,000 acres in the southern part of the state. Other small valleys in the mountain areas are equally important in respect to yields and quality of product. No district in the United States gives greater average yields than are obtained by some of the better growers in these mountain valleys. From 300 to 400 bushels an acre on large fields are not uncommon average yields, and this without the use of any fertilizer. A large part of the available potato lands of these high mountain valleys are as yet undeveloped and the acreage planted to this crop is rapidly increasing.

The cantaloupes grown at Rocky Ford and other points along the Arkansas Valley in Colorado have brought that district to the attention of the whole country. The natural adaptability of the soils and climate is such that the cantaloupe has become the leading "hoed" crop in general rotation with grain and alfalfa, over a large area of land. Thousands of cars of cantaloupes are shipped each year from the Rocky Ford territory and the market extends over all parts of the United States. The cantaloupe is also grown, for distant markets, in the Grand Junction district on the West Slope and, for local markets, in the Greeley district.

Cabbage-growing, on the East Slope, for distant markets is an industry of increasing importance. The northern Colorado irrigated district, with Greeley as a center, is now producing heavy yields of cabbage that are shipped to markets in the cotton- and grain-belt states. Wakefield and Winnigstad are grown for early shipments, while Scott's Cross, Flat Dutch and Ballhead are the most common late varieties. The high-altitude mountain districts are also well adapted to the growing of heavy yields of good-quality cabbage, but the transportation facilities are such that no considerable industry in cabbage-growing has been developed.

The onion is grown, not only for home use and local markets, but its production as a crop for shipping into distant markets has in several districts become of considerable commercial importance. The districts where onion-growing has become established as a permanent industry are Greeley, Pueblo and Cañon City on the East Slope, with Olathe as a center in the Uncompahgre Valley in the western part of the state.

One of the vegetable crops to which the irrigated lands of Colorado are admirably adapted is celery. This vegetable is being grown for local consumption in all parts of the state. The growing of celery for distant markets is steadily on the increase, and is being found generally profitable, in the region above Denver, Pueblo and near other towns where stable manure can be procured for fertilizing the land.

Peas grow well in all the higher parts of the state. In the San Luis Valley, the Canada field pea is grown extensively as a field crop for feeding sheep and hogs. The garden pea is grown for the canning industry in the vicinity of Longmont, Loveland, Greeley and Ft. Lupton, at which places canneries are located. Other canning crops are also grown in these same districts, as

beans, tomatoes and the like, but the pea is by far the most important.

Another horticultural crop that gives promise of future importance in Colorado is cauliflower. This vegetable, like the cabbage, thrives better as the altitude becomes higher, and is grown to perfection at 7,000 to 9,000 feet. Growers in the high altitudes frequently grow individual "flowers" weighing from six to ten pounds, perfect in every way, and many growers claim that a yield of 20,000 pounds an acre is not difficult to obtain.

The florist and forcing industries of the state are limited for the most part to the growing of flowers and vegetables for local trade only. Each city or small town has one or more greenhouse plants and the larger cities of Denver, Pueblo and Colorado Springs have extensive forcing and greenhouse establishments.

The larger part of the flowers and shrubs common to the northern sections of the United States must be included in the list of outdoor plants for Colorado. Their use, however, is limited largely to the home and town or city parks. Most biennials and herbaceous perennials that are grown in the North grow well in Colorado at the altitude of Denver and in many cases at much higher altitudes, though some shrubs need more or less winter protection to prevent killing back to the ground. Many ornamental shrubs and trees that are native to the mountains of Colorado are used as ornamentals both in Colorado and elsewhere. The arid lands of the plains and mountains abound with many beautiful trees, shrubs and plants which would be of value for transplanting as ornamentals but for their tendency toward slow growth, which has made it possible for them to exist under the arid conditions of that climate.

Most vegetables, fruits and flowers that are adapted to a cool climate are at their best in the larger part of the irrigated sections of Colorado. Eighty-five per cent of all the days of the year are cloudless and in the cool dry air, fungi are not generally troublesome as compared with the more humid parts of the United States. Plants that require a warm climate or a long season, as the tomato, cucumber and sweet potato, are grown successfully in the warmer parts of the state, but for the most part such crops have not made the marked showing that has been made by the fruits and vegetables adapted to a cooler climate.

Few individuals stand out prominently as having been especially instrumental in the development of Colorado horticulture. Jesse Frazier, of Florence, was one of the first men of the state to plant apples extensively. In 1864 he brought trees from Missouri and his orchard still bears evidence to the care and skill with which it has been handled. Capt. B. F. Rockafellow, of Cañon City, whose orchard of apples and cherries, planted about forty years ago, is still producing profitable crops, was also instrumental in the development of fruit-growing in that district. J. S. McClelland, of Fort Collins, was one of the earliest and most successful nurserymen and orchardists of the state. His trials of varieties and methods of culture did much to make fruit-growing a success in that region. W. S. Coburn, of Paonia, who was for several years president of the State Horticultural Society, was one of the first of the West Slope growers to plant heavily, as was also Mr. Steele who planted one of the first orchards in the Grand Junction district.

Public-service agencies for horticulture.

The development of all the different horticultural activities in a climate totally different from that of the older parts of the country, necessitated the solution of many new problems. From time to time public-service agencies have been created to take care of these problems. In 1879 an act of the State Legislature created a Board of Agriculture whose duties were largely to

organize and control a State College of Agriculture. The same year, the College was established at Fort Collins in northern Colorado, according to the Land-Grant Act of Congress of 1862. The College, together with the State Agricultural Experiment Station which was organized in 1887 and established at the same place, has done much for the horticultural interests of the state. The numbers of the horticultural staff of the College and Station has varied with the support given the institution by the state. At present it comprises four men, all located at Fort Collins. Up to the present time fifty-six bulletins have been issued by the Experiment Station that relate to or have a direct bearing on the horticultural problems of Colorado.

Instruction in horticulture is given among the farmers of the state through the agency of farmers' institutes, and one-week short courses in horticulture are held in the various horticultural centers of the state. Horticulture is also taught in many of the graded and high-schools of Colorado.

A State Horticultural Society was organized in 1880 which is still active. In 1903 a bill was passed by the Colorado Legislature establishing a Board of Horticulture, the object of which was similar to that of a State Horticultural Society. The 1913 Legislature abolished this Board and created in its stead the office of State Horticulturist. By the provisions of this act, the Horticulturist of the State College is State Horticulturist and his duties are to assist the horticulturists of the state by giving them advice or investigating such problems as may arise.

An act of the Legislature of 1909 made the Entomologist of the State Agricultural College, ex-officio, State Entomologist. The duties of this office are to inspect all nursery stock grown or shipped into the state and to destroy or reject all found infested with injurious insects or fungous diseases.

Statistics (Thirteenth Census).

The approximate land area of Colorado is 66,341,120 acres. Of this area, there are 13,532,113 acres in farms, or 20.4 per cent of the land area; 31.8 per cent of the farm land, or 4,302,101 acres, are improved; 891,698 acres are in woodland, and the unimproved land in farms totals 8,338,314 acres. The number of all the farms in 1910 was 46,170. The average acreage to the farm was 293.1. [The total area is 103,948 square miles.]

The leading agricultural crops are cereals, hay and forage, sugar crops, and broom-corn. The acreage of cereals in 1909 was 1,057,905, as compared with 525,299 in 1899, showing an increase of 101.4 per cent. The value of the cereals in 1909 was \$14,787,519. Hay and forage in 1909 occupied 1,285,064 acres, as compared with 952,214 acres in 1899, an increase of 35 per cent. The value of hay and forage produced in 1909 was \$17,282,276. Sugar crops are significant in that the acreage has shown an increase of 9,615.7 per cent in the period from 1899 to 1909. The acreage in 1909 was 111,251; in 1899, 1,145. The value of the sugar crops in 1909 was \$6,104,672; in 1899, \$27,818, showing an increase in value of 21,844.8 per cent. The acreage of broom-corn in 1909 was 5,631; in 1899, 1,241, showing an increase of 353.7 per cent. The value of forest products from the farms in 1909 was \$305,719; in 1899, \$113,055.

The leading horticultural crops of the state are fruits and nuts, vegetables, including potatoes, sweet potatoes and yams, flowers and plants and nursery products, and small-fruits. The value of all fruits and nuts in 1909 was \$4,680,142, or 9.2 per cent of the total value of all crops grown; vegetables in 1909, including potatoes, sweet potatoes and yams, were valued at \$6,058,939, or 11.9 per cent of the total value of all crops. Flowers and plants and nursery products in 1909 were valued at \$540,775 as compared with \$264,415, their valuation in 1899. The acreage of small-fruits in 1909

was 2,829, an increase of 20.5 per cent since 1899, and their value \$398,836.

Apples are the most important of the orchard-fruits, with peaches and nectarines ranking second. In 1910, the apple trees of bearing age numbered 1,688,425; those not of bearing age, 1,972,914. The production of apples in 1909 was 3,559,094 bushels, valued at \$3,405,442. The peach and nectarine trees of bearing age in 1910 numbered 793,372; those not of bearing age, 606,001. The production in 1909 was 692,258 bushels, valued at \$764,561. The other orchard fruits and their production and value of their products in 1909 follow: pears, 132,536 bushels, valued at \$210,685; plums and prunes, 81,539 bushels, valued at \$81,354; cherries, 88,937 bushels, valued at \$173,895; apricots, 11,403 bushels, valued at \$15,658.

The number of grape-vines of bearing age in 1910 was 251,292; those not of bearing age, 101,332. The production in 1909 was 1,037,614 pounds, an increase of 77 per cent over the production in 1899. The value of the grape products in 1909 was \$28,026.

The quantity of nuts produced in 1909 was 7,796 pounds, valued at \$324. The nuts included in this grouping are Persian or English walnuts, black walnuts, almonds, chestnuts, pecans, Japanese walnuts, hickory-nuts, filberts, hazelnuts, and others.

Of the small-fruits grown, raspberries and loganberries are the most important in value, with strawberries second. Considered from the standpoint of production this order is reversed. The acreage of strawberries in 1909 was 1,326, producing 1,674,923 quarts of berries, valued at \$156,059. The acreage of raspberries and loganberries in 1909 was 801, producing 1,650,785 quarts of berries, valued at \$156,668. Other small-fruits, their production and value were, in 1909: blackberries and dewberries, 227,598 quarts, valued at \$27,833; currants, 493,726 quarts, valued at \$39,935; and gooseberries, 247,956 quarts, valued at \$18,341. The acreage in each case in 1909 was, 195, 226, and 122 acres respectively.

Of the vegetables, the potatoes, sweet potatoes and yams were the more important. The acreage of the potatoes, sweet potatoes and yams in 1909 was 85,860, an increase of 94.7 per cent since 1899. The production was 11,783,501 bushels, valued at \$3,709,305. Other vegetables in 1909 occupied 32,422 acres, producing products valued at \$2,349,634. The acreage and value of the more important vegetables in 1909 follow: 2,568 acres of cabbage, valued at \$180,964; 3,970 acres of cantaloupes and muskmelons, valued at \$334,291; 357 acres of celery, valued at \$110,114; 577 acres of onions valued at \$64,665; and 1,646 acres of tomatoes, valued at \$138,339. Other vegetables grown are asparagus, green beans, sweet corn, cucumbers, lettuce, green peas, turnips and watermelons.

The acreage devoted to the growth of flowers and plants in 1909 was 154; in 1899, 137. The area under glass was, in 1909, 1,340,824 square feet, of which 1,244,425 were covered by greenhouses and 96,399 by sashes and frames. The total value of flowers and plants produced in 1909 was \$468,685.

The acreage occupied by nursery establishments was 241 in 1909, as compared with 497 in 1899, showing a decrease of 51.5 per cent. The value of the nursery products, however, increased 9.3 per cent during that time, from \$65,936 in 1899 to \$72,090 in 1909.

E. R. BENNETT.

New Mexico.

New Mexico (Fig. 2528), though rich in mineral resources and in its salubrious climate is, nevertheless, an agricultural commonwealth. Because of its location in the southwestern part of the United States, it is sometimes thought by persons not familiar with its topography and other physical conditions that it must

have a tropical or at least a semi-tropical climate. This would probably be true if it were not for its great elevation. The high altitude gives New Mexico a temperate zone climate suitable for temperate zone fruits and other plants. New Mexico is mostly a country of mountains, valleys and prairies. Spurs of the Rocky Mountain system extend from north to south through the central and western parts of the state. The extreme eastern part, with an altitude varying from about 3,000 feet in the extreme southeast corner to about 5,000 feet in the northeast part, partakes more of the nature of a prairie country. This part has a larger average rainfall than the central and western agricultural valleys and during the last ten years it has developed extensively into a dry-farming section. The rainfall, however, is not enough to insure satisfactory results in the growing of fruits and vegetables, particularly on a commercial scale.

Some of the higher horticultural districts in which many fruits and vegetables succeed, range from 6,000 to 7,500 feet. This is the altitude of such places as Santa Fe, Mountain Park, Cimarron, Las Vegas and Taos; while the Roswell, Carlsbad, Las Cruces, Socorro, Albuquerque and Deming districts, in which horticulture has developed into a high state of cultivation, have altitudes varying from 3,100 at Carlsbad to 5,000 feet at Albuquerque. Perhaps the average height of New Mexico valleys and irrigable areas varies from 4,000 to 5,500 feet.

New Mexico is a large state, ranging fourth in size. On account of its being practically in the center of the arid section of the United States, however, it is impossible to utilize all of its large acreage for agricultural purposes. Only the places which can be irrigated, in the extreme eastern part of the state and any parts in between the mountains which get a fairly large amount of rain can be brought into cultivation. Out of its large acreage, it is now pretty well known that about 3,500,000 acres are irrigable and that 10,000,000 acres are claimed to be adaptable for dry-farming crops.

Since practically all of the truck and fruit crops have to be raised under irrigation, this discussion will be limited to those agricultural districts which are being developed by irrigation. Wherever water for irrigation may be had, either from rivers, reservoirs, springs, or wells, it is reasonably safe to expect good results from certain horticultural plants. Almost every county in the state has one or two districts in which horticultural operations may be conducted very successfully. The accompanying map gives the larger fruit-growing districts in the state, eleven in number. District No. 1 takes in part of Grant and Luna counties; district No. 2 takes in all of the Rio Grande Valley from Santa Fe down to the Texas line; district No. 3 is found mostly in Otero County around Alamogordo, extending somewhat into the mountains; district No. 4 includes all of the little mountain streams in Lincoln and Chaves counties; district No. 5 includes all of the Pecos Valley; district No. 6 takes in all of the mountain streams in northern New Mexico, mostly in northwestern and southern Colfax County; district No. 7 is found in Mora and San Miguel counties, in the southern and northwestern parts; district No. 8 includes parts of Santa Fe and Rio Arriba counties along the Rio Grande Valley and mountain streams; district No. 9 includes the old Taos Valley and the little mountain streams in Taos County; district No. 10 is located in the northwestern corner of New Mexico, mostly in San Juan County; district No. 11 is the Portales district in Roosevelt County, being developed by pumping.

At the present time the leading horticultural industries are fruit-growing and truck-gardening, fruit-growing being the leading and most important one. The horticultural districts in New Mexico, on the whole, are better suited for fruit-growing than for truck crops. The leading fruits are apples, peaches, pears, plums, and

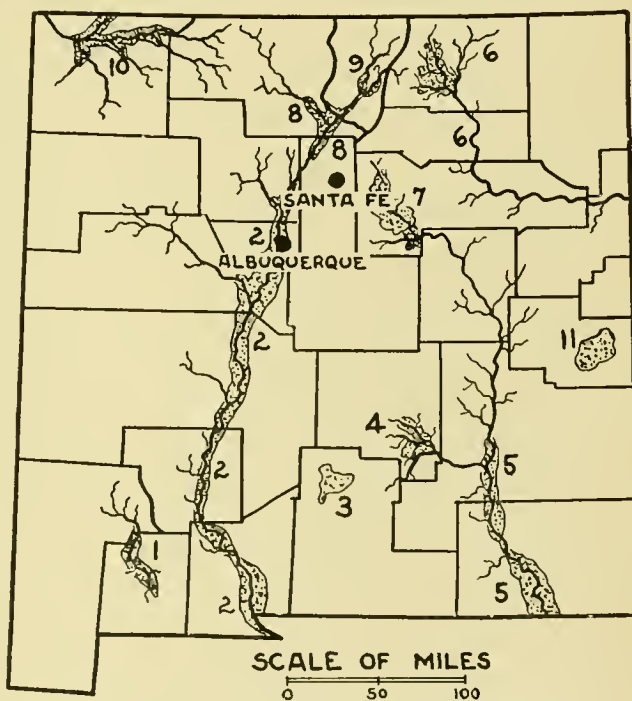
grapes. Some cherries and quinces are also grown. In the last ten years, much interest has developed in apple-growing. Many large apple orchards have been and are being planted in practically all of the horticultural districts. From all indications, it is safe to say that New Mexico will yet be an apple-producing state, though pears and peaches will also be grown on a large scale. The principal apple-growing sections at the present time may be found at Roswell, Dexter, Artesia, Hope, Mountain Park, Three Rivers, Cimarron, Taos, Española, Santa Fe, Albuquerque, Socorro, Las Cruces, Mesilla Park, Aztec, and Farmington.

New Mexico has many different kinds of climate and soil and for this reason it is impossible to make any definite statements as to the adaptability of varieties to all of the horticultural districts. As a matter of fact, it is found that certain varieties do better in certain parts of the state than in others. The most widely grown varieties in the state seem to be, at the present time, Red June, Early Harvest, Yellow Transparent, Maiden's Blush, Ben Davis, Mammoth Black Twig, Gano, Black Ben Davis, Winesap, Jonathan, Arkansas Black, Rome Beauty, and White Winter Pearmain. In the lower and warmer parts of the state, the Jonathan, King David, Ben Davis, Gano, Black Ben Davis, Winesap, Mammoth Black Twig, and Arkansas Black are among the leading varieties. In the cooler and higher altitudes these same varieties are popular, with the exception of the Mammoth Black Twig, King David and Arkansas Black. In place of these, Stayman Winesap, Delicious, Grimes' Golden and White Winter Pearmain are used. In the lower and warmer valleys, the Delicious apple varies very materially from the original Delicious type.

There are not so many pears being grown as there are apples, but in some of the horticultural valleys there is a marked interest being taken in growing this fruit. At the present time in district No. 2, particularly in the Mesilla Valley, many orchards are being planted to the Bartlett pear. So far this fruit has not been threatened by the dreaded pear-blight. The climatic and soil conditions seem to be particularly well suited to the pear in some of the lower and warmer districts. In 1914 the first two carloads of fancy Bartlett pears were shipped to New Orleans markets from young orchards in district No. 2. This industry promises to become a very important one. Aside from the Bartlett, the Doyenne d'Ete, Howell, Clapp Favorite, Flemish Beauty, D'Anjou, Winter Nelis, and Winter Bartlett comprise a good list of varieties of pears to plant in New Mexico. So far the Bartlett orchards have not shown any indications of trouble due to self-sterility of the variety. However, to be on the safe side, there should be at least two varieties used with the Bartlett, if for no other purpose than for cross-pollination. These varieties may be the D'Anjou, the Winter Bartlett, or Winter Nelis.

The peach probably holds second place among the orchard-fruits grown in the state at the present time. In the lower and warmer valleys this species grows very well and blooms very heavily. The greatest drawback to the peach is the injury to the blossoms or young fruit from the late spring frosts. This injury may be mitigated to some degree by the proper and judicious use of smudge pots. Peach-growing is conducted on a comparatively large scale in districts Nos. 2, 3, 5, and 10. The largest commercial peach orchards are to be found at Carlsbad, Tularosa, Las Cruces and Farmington. Most of the varieties that have been tried seem to do well, but the following is a list which has become somewhat popular and the varieties are given in the order

of their ripening,—Alexander, Hynes' Surprise, Texas King, Mamie Ross, Carman, Elberta, Late Crawford, Crothers, and Salway. The Alexander and Hynes' Surprise are the latest-blooming varieties and are the earliest to ripen. Because they are very late in blooming they are, as a rule, the surer bearers. The Texas King, Mamie Ross and Crothers are medium late in blooming and, as a rule, are sure bearers. In this class, so far as blooming is concerned, may be listed the Late Crawford and Salway. The earliest blooming commercial variety is the Elberta, and this peach fails oftener to bear than any other variety. Experiments show that it is not safe to count on more than one full crop in five years. The new peach, the J. H. Hale, which is very promising in many respects, appears to be an



2528. New Mexico, with the main agricultural and horticultural districts. (Irrigated districts.)

early bloomer, blooming as early, if not earlier, than the Elberta.

The apricot is one of the hardiest and most resistant fruit-trees to unfavorable conditions, but all of the varieties tried bloom entirely too early to escape the late spring frosts, and for this reason it is not considered a profitable fruit to grow.

Districts Nos. 1, 2, 3, 4, 5, 8, and 10 seem to be well suited for plum-growing. Almost any variety of plums seems to grow well in most of these districts. Varieties of the European group are best suited for New Mexico conditions, as they are extremely late bloomers. As a rule they bloom as late, and in some cases later, than the apples. Coe's Golden Drop, Jefferson, Imperial Gage, Green Gage, Pond's Seedling, Yellow Egg, Shippers' Pride, Robe de Sargent, German prune and French prune are among the leading varieties. The Japanese plums bloom entirely too early and for this reason they can hardly be expected to bear a satisfactory crop more than once in every five years. In this group of plums may be found some of the best eating and early ripening varieties. The Japanese plums are not considered profitable to grow. There are a number of satisfactory native plums. In this group may be found a wider range of blooming periods than

in any other group. A few of the later blooming varieties are the Wild Goose, Omaha, Wayland, Golden Beauty and Victor.

Cherries are not grown on a large scale at the present time, though trees of the sour varieties may be found growing in almost all of the fruit-growing districts. The sweet cherries do not seem to do nearly so well as the sour varieties. The Ostheim, Early Richmond, Montmorency and English Morello are some of the more popular sour cherries. The cherry trees, as well as the plum trees, are comparatively short-lived and in the lower and warmer valleys they are more or less subject to sun-scald.

The area devoted to grapes is not very large, though favorable climatic and soil conditions may be found in different horticultural districts. In the cooler and higher altitudes, the conditions are favorable for the American varieties, though very few American grapes are, at the present time, being grown in New Mexico. These varieties may be grown very satisfactorily in districts Nos. 1, 4, 5, 6, 7, 8, 9, 10, and 11. More grapes have been grown in district No. 2 than in all of the other districts put together. Varieties of the vinifera grape seem to be very satisfactory. Large vineyards are to be found in this locality, mostly of the old Mission grape. During later years, Thompson's Seedless, Chascelas, Black Hamburg, Muscat of Alexandria, Purple Damascus, Black Cornichon, Tokay, and Black Ferrara have been added to these plantations. The European grape grows and bears very satisfactorily, but it is somewhat tender and is liable to be winter-killed occasionally.

Much has been said about growing the date palm and figs in New Mexico. The winter temperatures are much too low, even in the warmer and lower valleys of the state, for the date palm to grow. The plant makes a good growth in the summer but it cannot stand the winter temperatures. The fig is a little more hardy and will stand zero temperatures frequently in the lower and warmer valleys. While the fig tree cannot be grown on a commercial scale, a few specimens may be planted in home plantations in southern New Mexico. The best results from these trees can be secured when they are planted either on the south or east side of a house or wall. When planted on the north or west side of the house, they are more liable to be winter-killed.

The small-fruits can be grown very satisfactorily. At the present time there are no large plantations in the state. On the whole, the best small-fruits are to be found growing in the higher districts. Strawberries, gooseberries and currants do well in the lower and warmer valleys and at the present time there is considerable interest being taken in strawberry-culture.

While, up to the present time, most of the horticultural industries have been the growing of fruits and vegetables, nursery and floricultural work is now attracting considerable interest. In the last two or three years a few nurseries have been started, mostly in district No. 5. Not much attention has been given, so far, to nut-culture in this state, though a few small experimental orchards of pecans, as well as a number of almond and English (Persian) walnut trees, have been set out.

Many vegetables can be grown satisfactorily. Among the most promising ones are asparagus, cantaloupes, melons, tomatoes, onions, sweet potatoes, red peppers, cauliflower, cabbage, spinach, peas, and beans. Because of the great distance to large vegetable markets, it is necessary to grow those vegetables which are less perishable and can stand shipping a long distance. Spinach in districts Nos. 1, 2, 3, and 5, can be grown very satisfactorily, particularly in the southern parts of districts Nos. 2 and 5. From there it may be shipped to the northern and eastern markets during January, February and March. Spinach in these districts yields from two to four tons an acre.

Sweet potatoes are grown all over the state, wherever irrigation is possible. Such varieties as the Southern

Queen and Red and White Bermuda grow very large and produce from 15,000 to 20,000 pounds an acre. The Yellow Nansmond and Yellow Jersey are the best commercial varieties, but they are not so large, yielding about 15,000 pounds an acre.

One of the most promising vegetables that will stand long shipments is the onion. Most of the varieties of onions will grow well; in the higher and cooler districts, varieties of the American type, such as the Brown Australian, Yellow Danvers, Red Weathersfield and White Globe are the most suitable. These varieties are more popular in the local markets than the larger growing kinds, but are not considered so profitable when they have to be shipped to eastern markets. On the other hand, the large-growing and mild varieties, such as the Giant Gibraltar, White Tripoli, and Denias are very suitable for the warmer and lower valleys, particularly in districts Nos. 1, 2, 3 and 5. The Denia onion is being grown in fairly large quantities in these districts.

Chile, or pepper, is a vegetable that has been grown for many years by the Mexican gardeners. It does exceedingly well, particularly in the lower and warmer valleys. The season in the higher altitudes is not long enough for it to ripen satisfactorily. Under favorable conditions it will produce a very large crop. The chile may be used in the green stage or in the red ripe form. It can also be canned in the green stage. The ripe chile may be used in the pod or powder form.

Tomatoes are grown rather extensively in districts Nos. 1, 2, 3 and 5. At Lakewood there is a tomato cannery, which is putting up some very good tomatoes. In the higher altitudes the season is not long enough for tomatoes to ripen satisfactorily.

Many other vegetables can be grown, and many of the more perishable ones are grown by the local truck-growers for local or nearby markets.

One of the first crops that the new farmer usually tries to grow, and the one that he first fails with, is the Irish potato. Unless he is at an altitude of about 7,000 to 8,000 feet, he is not likely to succeed very satisfactorily in the growing of Irish potatoes. For one reason or another, Irish potatoes do not produce satisfactory yields in the lower and warmer parts of the state. The best potato-growing districts in New Mexico are found in the higher and cooler parts. New Mexico grows a large amount of potatoes at these higher altitudes, but practically none is grown in the lower and warmer valleys.

The Catholic priests first set out plantations of Mission grapes up and down the Rio Grande Valley in the early periods. Later such early settlers as T. J. Bull, Thomas Casad, Rafael Ruelas, Rafael Bermudas and Roman Gonzalez were prominent figures in the development of horticulture in district No. 2, while the late Archbishop Lamy and Gaspar Ortiz, James J. Johnson, and Major Sena were among the early settlers to take much interest in the horticulture of district No. 8; and W. L. Thomson, and A. Ancheta were the pioneers in horticulture in district No. 1. The first one to start fruit-growing in district No. 5 was the late J. J. Hagerman who became the largest apple-grower in the Pecos Valley.

Public-service agencies for horticulture.

The Land-Grant Agricultural College is located in the Mesilla Valley in south-central New Mexico near Las Cruces, at State College. It was established in 1889. There are four instructors in horticulture on the teaching staff.

The United States Experiment Station is located at the same place as the College. There are eighteen on the station staff.

There are no special schools in the state where teaching in horticulture is undertaken. Some elementary horticulture is taught in some of the high-schools of the state.

Through the Experiment Station and the Extension Department a large amount of extension work in horticulture is going on all over the state.

There has been very little interest taken in the state relative to the inspection of trees for insects and diseases, though there is a state law providing for this work.

There has not been much interest in the state in horticultural organizations. In 1900 a horticultural society was organized with its headquarters at Santa Fe. At the present time there are boards of horticulture in San Juan and Chaves counties.

Statistics (Thirteenth Census).

The approximate land area of New Mexico in 1910 was 78,401,920 acres. The land in farms was 11,270,021 acres, or 14.4 per cent of the land area. Of this land in farms, 1,467,191 acres were improved; 1,491,025 were woodland; and 8,311,805 acres, other unimproved land. The number of all the farms in the state in 1910 was 35,676 and the average acreage to the farm 315.9. [The total area is 122,634 square miles.]

The leading agricultural crops of the state are hay and forage and cereals. The acreage occupied by hay and forage increased from 87,358 in 1899 to 368,409 in 1909, when the production was valued at \$4,469,709, or 50.1 per cent of the total value of all crops. Cereals increased in acreage from 96,402 in 1899 to 218,037 in 1909, when the production was valued at \$2,382,996, or 26.7 per cent of the total value of all crops. The value of the forest products of farms in 1909 was \$253,822, as compared with \$34,268 in 1899.

Horticultural crops produced in New Mexico are fruits and nuts, small-fruits, vegetables including potatoes, and flowers and plants and nursery products. The value of fruits and nuts produced in 1909 was \$536,165, as compared with \$231,211 in 1899. Small-fruits increased in acreage from 48 in 1899 to 66 in 1909, when the production was 76,532 quarts, valued at \$9,335. The total acreage of potatoes and other vegetables increased from 5,203 in 1899 to 14,660 in 1909, when the production was valued at \$820,497. Excluding potatoes, the acreage of vegetables increased from 4,034 in 1899 to 8,219 in 1909, when the production was valued at \$567,154. The production of flowers and plants and nursery products in 1909 was valued at \$40,303.

The total production of orchard-fruits in 1909 was 504,059 bushels, valued at \$519,677. Apples were the most important of the orchard-fruits, the production in 1909 being 417,143 bushels, valued at \$420,536. The number of apple trees of bearing age in 1910 was 542,528; those not of bearing age, 914,254. Peach and nectarine trees of bearing age in 1910 numbered 136,191; those not of bearing age, 184,466, and the production in 1909 was 32,533 bushels, valued at \$37,195. Pear trees of bearing age in 1910 numbered 37,220; those not of bearing age, 100,201, and the production in 1909 was 29,435 bushels, valued at \$29,688. Other of the orchard fruits produced in New Mexico were: 15,528 bushels of plums and prunes, valued at \$17,054; 6,384 bushels of cherries, valued at \$10,684; 2,379 bushels of apricots, valued at \$3,446; and 657 bushels of quinces, valued at \$1,074.

Grapes and nuts are of comparatively little importance in New Mexico. The production of grapes in 1909 was 425,415 pounds, valued at \$16,101; and that of nuts, 1,498 pounds, valued at \$195. However, the nut industry seems to be on the increase, since the total number of nut trees of bearing age in 1910 was 503, while those not of bearing age numbered as many as 5,199.

Strawberries are the most important of the small-fruits in New Mexico. The acreage increased from 9 in 1899 to 20 in 1909, when the production was 35,634 quarts, valued at \$4,086. The production of the other small-fruits in 1909 was: 10,089 quarts of blackberries

and dewberries, valued at \$1,698; 10,222 quarts of raspberries and loganberries, valued at \$1,581; 14,800 quarts of gooseberries, valued at \$1,348; 5,523 quarts of currants, valued at \$591; and cranberries to the value of \$10.

The acreage of potatoes increased from 1,122 in 1899 to 6,230 in 1909, when the production was 295,255 bushels, valued at \$234,636. Sweet potatoes and yams increased in acreage from 47 in 1899 to 211 in 1909, when the production was 13,831 bushels, valued at \$18,707. Other vegetables of importance produced in New Mexico in 1909 were: 491 acres of cantaloupes and muskmelons, valued at \$36,095; 260 acres of green peppers, valued at \$17,228; 106 acres of cabbage, valued at \$15,034; 287 acres of watermelons, valued at \$13,978; 49 acres of celery, valued at \$13,500; 97 acres of onions, valued at \$8,640; and 24 acres of asparagus, valued at \$7,660. Other vegetables produced were green beans, sweet corn, squash, tomatoes, and turnips.

The acreage devoted to the production of flowers and plants increased from 5 in 1899 to 8 in 1909, when the production was valued at \$31,121. The total area under glass in 1909 was 87,054 square feet, of which 59,752 square feet were covered by greenhouses, and 27,302 by sashes and frames. The acreage devoted to nursery products decreased from 32 in 1899 to 24 in 1909, when the value of the nursery products was \$9,182, as compared with \$5,753 in 1899. FABIAN GARCIA.

Arizona.

Arizona (Fig. 2529) is divided nearly equally into two climatic parts by a diagonal line running from northwest to southeast through the state. The region north and east of this line consists largely of plateaus, 5,000 to 8,000 feet above sea-level, diversified by isolated mountains and cut by eroded cañons, including the Grand Cañon. The southwestern half of the state is of comparatively low elevation and is crossed from northwest to southeast by a succession of low mountain chains and wide valleys.

Nearly the whole drainage of Arizona passes by way of the Colorado River to the Gulf of California. The little Colorado drains the northeastern plateau into the Grand Cañon, while the Gila River collects the drainage of the central and southern parts of the state and joins the Colorado just above Yuma.

In general, the climate of Arizona combines low rainfall with a very high percentage of possible sunshine, a long hot season, frosty minimum temperatures in winter, and low humidity. With respect to temperature and seasons, the state may be divided into two distinct regions: The northeastern elevated half is comparatively cool, with frostbound winters and temperate summers; the southwestern, and lower, half is arid, subtropical, with long hot summers, but with moderate frosts in winter.

With the help of irrigating waters, temperate-region crops are grown in the northeastern section, while a combination of temperate-region crops in winter and of subtropical crops in summer are grown in the southwestern section.

The daily range of temperature is great, averaging about 30° F., and occasionally reaching as much as 50° F. Relative humidities of less than 10 per cent occur in June; 80 per cent of possible sunshine occurs during the year; average wind-movement ranges from 2 to 3 miles an hour at lower altitudes to 6 to 7 miles at higher altitudes; and the maximum average annual evaporation of 86.51 inches has been observed at Tucson.

The average yearly precipitation in Arizona ranges from 3 to 5 inches along the Colorado River in the west, to as much as 35 inches in the form of rain and snow in the high mountain ranges of the state. The comparatively abundant precipitation of the high-

lands of Arizona gives rise to numerous never-failing streams, which converge to form the Little Colorado, Salt and Gila rivers. These streams finally empty into the Colorado River of the West, which derives its main flow from the distant watersheds of Colorado, Utah and Wyoming. The Salt, Gila, and other smaller streams, as they flow westward through the arid plains bordering upon the Colorado River, gradually evaporate, or are absorbed, and finally become intermittent in character, floods reaching their mouths only at infrequent intervals.

Numerous storage sites exist which are gradually becoming utilized for the storage of flood-waters, and

kins, martynias, and, in former times, probably, cotton and tobacco. Following the Indians came the Spaniards, from Mexico, who established themselves in the Santa Cruz Valley early in the eighteenth century. The Jesuits at their missions introduced Old World crops, including barley, wheat, apricots, cotton, dates, figs, grapes, melons, olives, onions, citrus fruits, peaches, pears, pomegranate, quinces and vegetable crops.

With the advent of Americans, dating from the Gadsden Purchase in 1854, agricultural and horticultural developments have been rapid, especially in irrigated parts of the state. Improved varieties of the crop-

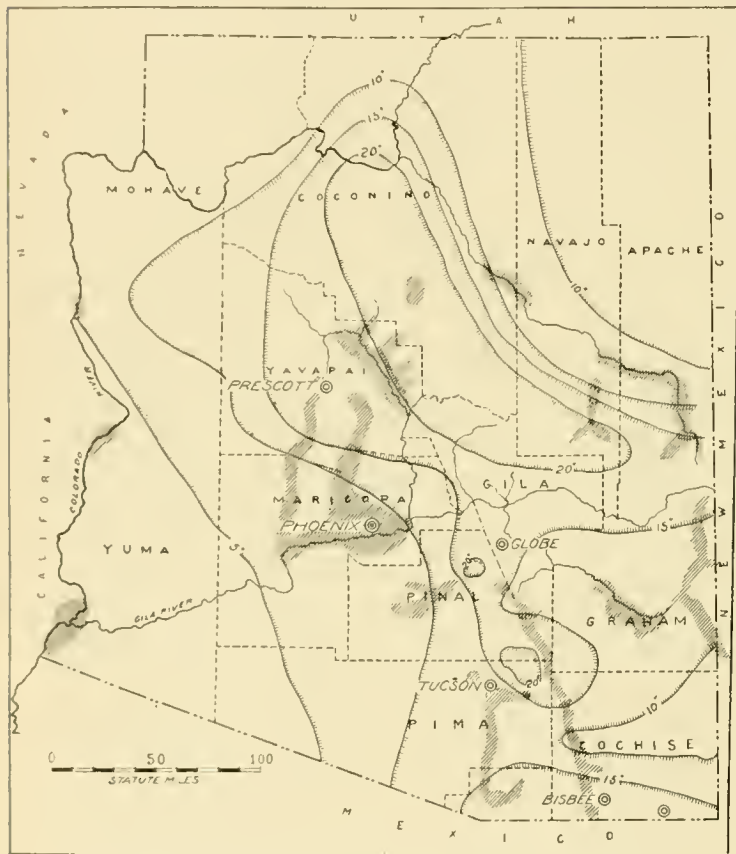
plants introduced by the Jesuits have been developed in large number, and in addition some crops new or previously little known have been imported, among them, alfalfa, apples, sugar-beets, the sorghums, cowpeas, eucalypts, millets, oats, plums, sweet and Irish potatoes, strawberries, tomatoes, and other fruits and vegetables.

Horticulturally, the state is divided into the northeastern elevated portion, best suited to deciduous fruits, summer vegetables and those ornamentals common in temperate climates; and the southwestern half of the state, of low altitude and higher temperatures, in which may be grown those subtropical plants which resist mild frosts and in which winter-growing vegetables and heat-resistant ornamentals thrive.

In the northeast, the leading horticultural products are apples, peaches, pears, plums and grapes. Strawberries, blackberries and a wide range of vegetable crops may also be grown, chiefly under irrigation. The most important of all horticultural crops at the present time is apples, which thrive vigorously at altitudes of 3,000 feet and above. The principal apple-growing districts are irrigated from the Gila River in Graham County and from the Verde and its tributaries in Yavapai County. Occasional orchards are scattered at higher altitudes throughout the state.

In the southwest, a great variety of subtropical and temperate-region crops are possible. Among the more distinctly subtropical plants, resistant to both heat and mild frost, are apricots, dates, eucalypts, figs, olives, oranges, pomelos, lemons, pomegranates and quinces; while many plants common to more temperate regions may be adapted to these lower altitudes, such as grapes, peaches, pears, plums, strawberries, and many vegetables which may be grown during the cooler fall, winter and spring seasons. Among the most important horticultural features of the southwestern half of Arizona, are the olive, the date palm, figs, grapes, and specialties, such as sugar-beets, cantaloupes and winter-grown vegetables. An attractive array of flowers, grown chiefly in the winter season and having commercial possibilities, includes roses, sweet peas, dahlias, and many flowering bulbs.

Various horticultural specialties are possible in Arizona at all seasons of the year. At higher altitudes apples are the most important horticultural crop. Among the most satisfactory varieties grown are Ben Davis, Arkansas Black, Gano, White Winter Pearmain, Jonathan, Limber Twig, and others. Excellent



2529. Arizona, showing the areas of horticultural development.

the ground-waters of the region are being rapidly developed by means of pumping-plants and artesian wells.

In a region where the rainfall is so inadequate for the irrigation of the entire area, horticultural pursuits can only be developed under the constant streams of higher Arizona, and the never-failing Colorado; where flood-waters can be stored, or where ground-waters are available. Only in higher or more favored areas is it possible to cultivate orchards or gardens, depending upon rainfall only. The horticultural districts of the state, therefore, are located almost entirely according to available irrigating water-supply. These districts, so far as they are at all developed, are indicated upon the accompanying map.

Irrigation was first practised at favorable points throughout Arizona by prehistoric peoples, the ruins of whose dwellings and ditches yet exist. Among the crops cultivated by the Indians, are quick-growing varieties of Indian corn, native beans, squashes, pump-

markets for the entire crop are to be found in the populous mining towns of the state; and consequently, practically no outside shipments are made. Peaches and pears are grown to the best advantage in irrigated valleys at higher altitudes, although they will also endure fairly well climatic conditions as low as Yuma. The Elberta peach is probably the best all-round variety for Arizona, although Late Crawford, Salway, Sylphide Cling, and others, do well. Among pears, the Kieffer produces fruit of comparatively fair quality for this variety; while Le Conte, Bartlett, Winter Nelis, and others, may be grown. A great advantage of the Kieffer is its resistance to blight, which badly affects other varieties in the region. Peaches and pears are also locally consumed, not yet being produced in sufficient quantity for outside shipments. Grapes produce abundantly in all sections, American varieties being grown at higher altitudes, while European varieties do best in the lower and warmer irrigated valleys. Raisins may also be manufactured from suitable varieties of grapes in those parts of Arizona sufficiently free from summer rains to permit of outdoor drying. Oranges, including Washington Navel, Valencia, Ruby, St. Michaels, Jaffa, and Mediterranean Sweet, can be grown at higher levels, in irrigated valleys up to 1,200 feet altitude in southern Arizona. Pomelos, including Marsh Seedless, Triumph, Duncan, and Aurantian, produce fruit of superior appearance and good quality. Lemons are profitably grown in the least frosty parts of the citrus districts.

Citrus fruits ripen in Arizona well in advance of the California crop, and as yet, fortunately, the orchards are entirely free from the pernicious scale insects which infest the orchards of California and Florida. These advantages, together with abundant and dependable water-supplies developed by the United States Reclamation Service and other projects in southern Arizona, give the citrus fruit-grower of the region special advantages in supplying eastern markets. Development of the citrus industry is therefore taking place rapidly, and probably will soon be the most important horticultural industry in Arizona.

The olive, which comes from semi-arid parts of the Old World, is at home in the lower irrigated valleys of Arizona. The trees grow vigorously with moderate water-supplies and are entirely free from the black scale which so disfigures the orchards of southern California. The quality of fruit produced is high, and the development of the oil and pickling industries is rapidly taking place at this time. The varieties best suited for pickles are Mission, Manzanillo, Sevillano; those best suited for oil are Mission, Correggiola, Nevadillo, Razza, Pendulina, and others. On account of its drought-resistance, the olive will undoubtedly be developed in parts of southern Arizona not having sufficient water for the more intensively cultivated crops.

The date palm is a very interesting and promising crop for altitudes up to 2,500 feet. In parts of north-west Mexico, resembling southern Arizona in climate, date palms up to 200 years of age, producing heavy crops, indicate a successful outcome for the many trees that are now being planted in southern Arizona. The selection of varieties of dates is exceedingly important because of the great difference in quality, productiveness and time of ripening of the different varieties. Although conditions in southern Arizona generally resemble those in date-growing regions of the Old World, they are sufficiently different in detail to reopen the whole question of the particular sorts best suited to Arizona conditions. At Tempe, 124 varieties of Old World dates have been under trial for fifteen years to determine the types best suited to Arizona conditions. Among the varieties at present approved for Arizona are Hayany, Khadvawi, Kustawi, Maktum, Moltagi, Nazl el Bacha, and possibly Deglet Noor,—the ideal being an early semi-dry cane-sugar date of

high quality, ripening on the bunch, as far as possible, at one time.

The palm has many enemies, including rats and gophers, which may be controlled by poison and explosives; and date palm scales from the Old World, which multiply enormously under southwestern conditions. These, however, can be controlled by the blast-torch treatment, and by carbolic sprays. The fruit is damaged by untimely rains, by fruit-eating beetles, and by a spot-fungous disease which thrives in damp weather. To some extent these difficulties may all be overcome by artificial ripening processes, by means of which the mature but not yet soft fruits may be removed in bunches from the trees and artificially ripened by chemical or thermal treatments which hasten the maturing process, in rooms protected from insect pests or weather. Pasteurization of the finished product also kills the maggots and insect eggs which would otherwise in a short time ruin the product.

Many varieties of Adriatic figs are grown at altitudes up to 3,000 feet. Climatic conditions, especially along the Colorado River, are also favorable to the culture and handling of Smyrna figs, which, however, have not yet been developed because of the time required to establish Capri figs suitable for the maintenance of the *Blastophaga* wasp. Smyrna figs, however, should in time become an important horticultural asset of the region.

Heavy yields of cantaloupes of high quality are of frequent occurrence. Six cantaloupe-growers' associations have been organized in Arizona at different times, and the annual shipments are probably not far from 400,000 crates of melons.

Sugar-beets have been grown as a winter and spring crop, being planted in southern Arizona from December to February and harvested mostly during June and July.

Winter onions produce abundantly, crops of 20,000 pounds an acre of White Bermudas being recorded.

Strawberries produce from February to November in southern Arizona, the Arizona Everbearing being a productive variety originating in the region.

Beginnings are being made in various horticultural industries, such as the manufacture of olive oil and pickles, tomato canning, and the like.

On account of the newness of the region, the nursery business is only in its beginning, the larger part of nursery stock and seeds being imported from other states. Citrus stock for home trade, however, will soon be produced exclusively in Arizona, largely on account of the quarantine regulations established under the Crop Pest Law. The two largest nurseries in the state are located near Phoenix and Safford, respectively, and serve the Salt and Gila River valleys, in which they are located. The opportunity for developing varieties especially adapted to the region is exceptional, experience having shown in other new districts, especially in California, that the best varieties for a region are finally found to be those which originate there.

Public-service agencies for horticulture.

The Land-Grant school of Arizona is situated at Tucson. It was legally established in 1885, but operations did not begin until 1891. There are but two members of the horticultural staff.

The Experiment Station is also located at Tucson, although the cultural work is distributed through the state as follows: gardens and greenhouses at Tucson; experimental farm near Phoenix; date orchards and intensive gardens at Tempe and Yuma; dry farms at Cochise, Prescott and Snowflake. The staff consists of nineteen scientific workers. The number of horticultural bulletins and timely hints for farmers is approximately thirty-three.

The inspection of nurseries and orchards is in charge of the Horticultural Commission, a board of three members.

High-school courses to include the teaching of horticulture and agriculture have been endowed by the first state legislature of Arizona. All high-schools providing facilities for agricultural instruction are entitled to receive to the amount of \$2,500 a year. Under the stimulus of this endowment, nine high-schools have installed these courses of instruction.

Associations exist for the marketing of oranges in Salt River Valley, of apples in the Verde and Gila valleys, and of miscellaneous produce in the Yuma and Gila River valleys. For the advantageous marketing of crops, association is necessary in a region somewhat distant from markets, and the movement toward association in connection with all horticultural industries in Arizona is strong.

Statistics (Thirteenth Census).

The land area of Arizona is 72,838,400 acres, of which 1.7 per cent, or 1,246,613 acres, is in farms. Of this land in farms, 28.1 per cent, or 350,173 acres, are improved; 100,061 are woodland; and 796,379 unimproved. [The total area is 113,956 square miles.]

The leading agricultural crops are hay and forage and cereals. The hay and forage occupied 102,490 acres in 1909 compared to 92,674 acres in 1899, an increase of 10.6 per cent. The value of hay and forage in 1909 was \$2,553,228. The acreage in cereals in 1909 was 75,269; in 1899, 53,958, showing an increase of 39.5 per cent in acreage. The value of cereals in 1909 was \$1,570,853. The value of the forest products in 1909 was \$45,312; in 1899, \$48,877. The value of sugar crops in 1909 was \$251,602. The acreage in sugar crops increased 2,656.8 per cent in the past decade, from 183 acres in 1899 to 5,015 acres in 1909.

The leading horticultural crops and their value in 1909 were as follows: potatoes \$126,695; other vegetables \$379,293; fruits and nuts, \$334,598; flowers and plants and nursery products, \$15,712; small-fruits, \$12,987.

The production of all orchard fruits increased 35.8 per cent in quantity from 1899 to 1909. The value increased from \$96,764 in 1899 to \$241,110 in 1909. Apples and peaches and nectarines lead in quantity of production and value. The number of bearing apple trees in 1909 was 62,027; of trees not of bearing age 53,881. The production in 1909 was 72,814 bushels valued at \$109,395. The number of trees of bearing age in the case of peaches and nectarines was, in 1910, 51,415; those not of bearing age 32,562. The production was 50,102 bushels valued at \$80,325. The production and value of the other orchard fruits in 1909 were as follows: pears, 13,289 bushels, valued at \$21,331; plums and prunes, 8,420 bushels, valued at \$16,261; apricots, 6,849 bushels, valued at \$10,053; quinces, 1,815 bushels, valued at \$2,805; cherries, 476 bushels, valued at \$840.

There were 131,579 vines of grapes of bearing age in 1910 and 84,510 not of bearing age. The production in 1909 was 837,842 pounds and its value \$25,371.

The principal nuts grown in Arizona are the almonds and pecans. In 1910, the almond trees of bearing age numbered 6,639; those not of bearing age, 845. The production of almonds in 1909 was 33,759 pounds, and their value \$1,193. There were, in 1910, 64 pecan trees of bearing age and 212 trees not of bearing age. The production in 1909 was 1,075 pounds, and value \$131.

The number of tropical fruit-trees of bearing age in 1910 were 51,036. They included, 818 pomelos (grapefruit); 1,216 date trees; 776 pomegranates; 9,353 olives; 33,373 oranges; 3,848 figs; and 1,652 lemons. The production and value in 1909 were as follows: pomelos, 820 boxes, valued at \$1,508; dates, 6,500 pounds, valued at \$96; pomegranates, 23,360 pounds, valued at \$177; 264,895 pounds of olives, valued at \$3,073; 32,247 boxes of oranges, valued at \$52,311; 127,081 pounds of figs, valued at \$4,103; and 1,010 boxes of lemons, valued at \$2,034.

The total production of all small-fruits in Arizona in 1909 was 112,190 quarts, and in 1899, 129,000 quarts, and their value was \$12,987 in 1909, as compared with \$12,265 in 1899. The most important of the small-fruits grown in 1909 were strawberries, there being 58 acres devoted to the crop, producing 95,247 quarts, valued at \$10,775. The production of blackberries was 13,808 quarts, amounting in value to \$1,761. The other small-fruits were raspberries, loganberries, currants and gooseberries.

The leading vegetables were potatoes, sweet potatoes and yams, onions, tomatoes and watermelons. In 1909, from 1,151 acres of potatoes, there were produced 97,141 bushels, valued at \$98,597. The acreage of sweet potatoes and yams in 1909 was 200, the production of which was 21,206 bushels, valued at \$28,098. The production of onions in 1909 was valued at \$11,480, and that of tomatoes \$9,239. The value of watermelons from 735 acres, in 1909, was \$52,502.

The area of land under glass, in 1909, used for the production of flowers and plants, was 29,810 square feet. Of these, 26,730 were covered by greenhouses and 3,080 by sashes and frames. The value of the products from flowers and plants was \$11,177.

As regards nursery products, the value, in 1909, was \$1,535, as compared with \$2,914 in 1899. From 1899 the area devoted to the production of nursery products increased from 14 acres to 18 acres in 1909.

R. H. FORBES.

Utah.

The whole state of Utah (Fig. 2530) is cut up with mountain ranges running in a north and south direction. Between these mountain ranges lies the agricultural land of the state. These valleys vary in size from only 1 or 2 miles across, such as Pine Valley, to 30 or 40 miles in length by 8 to 15 miles in width, such as Cache Valley. The deep rich soil in these valleys makes a very intensive type of agriculture possible. The main fruit sections are at an altitude of 4,000 to 4,800 feet above sea-level. This includes the sections around Brigham, Ogden, Salt Lake, Green River, and Provo. At a higher altitude, frost-injury is likely to be experienced except in specially favored spots of limited area. Such small areas are usually at the mouths of cañons. The most desirable orchard sites are situated on the bench-lands and near cañons, thus insuring good air-drainage to ward off the occurrence of late spring frosts. Several extensive observations have been made which show that the average minimum temperature in the valley bottoms is from 8° to 10° F. lower than the bench-lands. The winter temperatures are congenial to apple-, pear-, peach-, plum- and sour cherry-production even in the northern part of the state, whereas apricots, sweet cherries and Persian walnuts thrive along the bench-land from Brigham southward. Almonds are being produced in the favored sections in the vicinity of Salt Lake City.

The average rainfall throughout the orchard sections of the state varies from 8 to 17 inches. With most of the rainfall coming during the dormant season, irrigation is necessary for practically all kinds of fruit-production in the state. The larger part of the orchards receive water from some of the irrigation canal systems. However, many acres of fruit have been developed about Brigham by pumping from wells. These wells vary in depth from 30 to 80 feet. Most of the pumps are operated by electricity which is obtainable at a very cheap rate.

Sagebrush (*Artemisia tridentata*) is the natural vegetation of the best orchard soils. Such soils are generally deep, rich and free from alkali. Greasewood (*Sarcobatus Baileii*) and rabbit-brush (*Bigelovia* sp.) are found on soils containing more or less alkali, and perhaps otherwise unfit for fruit land.

The Mormons were the first to grow fruit in the intermountain region. With their first immigration to Utah in 1847, they brought seeds of grains, vegetables, fruit, shrubbery, trees, and vines. In a state thus settled by an agricultural people, fruit-growing became established early in its history, and held a place of importance in the agricultural development of the state. Practically every farm in the early days had its family orchard, consisting of many varieties of apples, peaches, plums, pears and cherries. Many of these trees were grown from seed. The following fruits which are gradually taking an important place in their respective classes originated in the state of Utah: the Poorman gooseberry, the Early Elberta peach, and the Knudson cherry. The planting of mixed orchards for local market purposes was well established as early as 1875. Bancroft, the historian, states that at this time there were from 500 to 600 acres of grapes in

tarian, are likely to suffer from late spring frosts in Cache County. Small fruit-growing areas have been developed recently in the vicinity of Price, Carbon County, and Green River, Emery County. Washington County is one of the oldest and it is naturally the most favored fruit section in the state. With a semi-tropical climate, this region excels in the production of the stone-fruits, European grapes, figs, pomegranates, almonds and Persian walnuts. Seclusion from railroad transportation has kept this country from developing a world-famous fruit-growing region.

Apples are the chief fruit crop of the state and make up more than half of the total acreage in orchards. With the exception of a few orchards planted for local markets, all commercial orchards are composed of late fall and winter varieties; chief among these are the Jonathan, Winesap, Rome, Ben Davis, Gano, Arkansas, Banana, and Rhode Island.

The peach orchards of Utah have been developed almost entirely to supply the fresh-fruit markets; therefore, the Elberta orchards compose nearly 90 per cent of the total acreage in peaches. Other varieties occasionally found are the Early Elberta, Early Crawford, Late Crawford, Lemon Cling, Tuscan, Champion, Alexander, and Hale's Early.

Cherries are the next most important fruit crop of the state, being produced chiefly around Brigham, Ogden, Salt Lake City and Provo. Most of this crop is sold in the fresh state among the markets of the intermountain region. A very firm high type of cherry is produced. Chief among the varieties are Napoleon, Tartarian, Hortense, Bing, Lambert, Windsor, Morello, Knudson, Double Natte, and Late Duke.

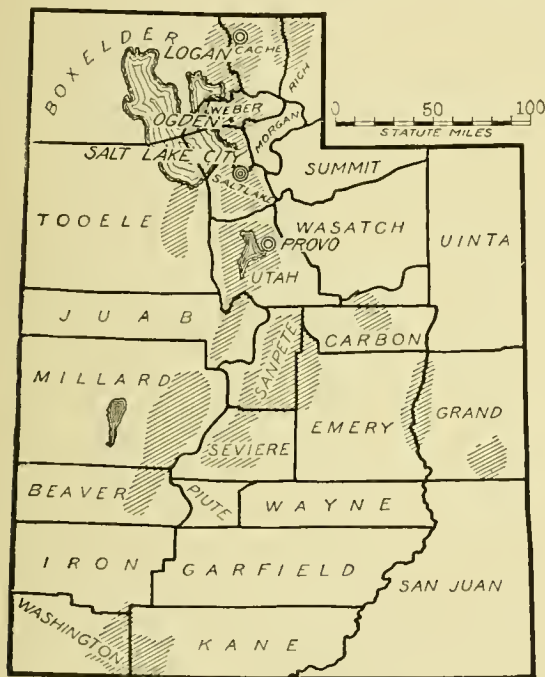
Small-fruits are produced for local markets and markets of the surrounding intermountain states. Strawberries, raspberries, dewberries, currants and gooseberries are readily produced practically throughout the state.

Pears, plums and apricots have been somewhat neglected in developing the fruit industry of the state, and although the nearby markets are partly supplied with Utah fruit of the above sorts, these fruits form a small part of the export trade of the state.

The grape, however, is the most neglected of all fruits in the state. The common American varieties can be successfully produced throughout the northern and central parts, and some of the most hardy European sorts, as the Thompson, can be produced from Box Elder County south to Washington County. Grapes are among the chief fruits in the latter county, where the following vinifera varieties are produced in abundance: Flame Tokay, Cornichon, Thompson's, Black Ferrara, and Muscat of Alexandria.

Utah apples, peaches, pears and cherries are packed almost entirely in boxes. The chief markets for this fruit are in the intermountain and plains states, where stock-raising and grain-production are the chief industries. The southern cotton states are also good markets for Utah fruit. Storage facilities have not been well developed as yet and oftentimes fruit is sold at a moderately low price by being rushed to an overstocked market.

Diversified fruit-growing is often encountered in Utah. Many orchardists grow several kinds of small-fruits as well as stone-fruits. Apples are often grown as one of the principal crops on a general farm. For example, the farmer may have 10 acres of apples, and 20 acres or more of such crops as sugar-beets, alfalfa, or vegetable crops for cannery purposes. With this system of farm management, the cost of production of the fruit crops is somewhat lower than on the more specialized fruit-farms, where the owner's time is not fully occupied throughout the year. Much of the general farm equipment can be used in the orchard, while the presence of live-stock on most of the fruit-farms goes a long way toward solving the question of



2530. Utah, with important horticultural areas.

southern Utah, and the value of Utah's fruit products of all kinds was estimated at \$157,000. The planting of commercial orchards for the general markets began about 1895 to 1900. This industry increased manyfold from 1900 to 1910.

With the variations in altitude, soil, and exposure which exist within the state of Utah, it is possible to grow a great variety of fruits. Only the harder apples, pears and small-fruits are grown successfully in the regions of high altitude, such as Summit and Rich counties, in the northern part of the state, where the altitude is 5,500 to 7,000 feet above sea-level. However, pomegranates, figs, and European grapes are grown to perfection in Washington County in the southwestern corner of the state at an altitude of 2,880 feet.

The chief fruit-growing sections are along the uplands at the foot of the west slope of the Wasatch Mountains from Brigham and vicinity to Provo and throughout the Bear River Valley. Cache County, at the north of the state, has a most favorable climate and soil for apple-production. Peaches and sour cherries are also a success here wherever suitable soil is obtainable. All except the most hardy sweet cherries, such as the Tar-

maintaining soil fertility. Clean cultivation is practised in most of the bearing orchards, although some attention has been directed recently to the soil-mulch system of orchard management. The latter system seems to have considerable promise in the sections where irrigation water is not the limiting factor. While the young orchards are being grown to a bearing age they are usually intercropped with some vegetable or small-fruit crop, as sugar-beets, tomatoes, strawberries, and the like. Cover-crops are the exception rather than the rule, and the application of chemical fertilizers is practically unheard of within the state. Thus far the application of moderate amounts of stable-manure seems to have maintained the plant-food and humus.

Irrigation water is usually applied by the furrow system. The basin system is occasionally used, however, in the case of orchards growing a sod or a cover-crop. The number of irrigations necessary to produce a crop of fruit will vary considerably with the soil conditions and the kind of fruit. Apples on the clay-loam soils are usually watered three or four times during the season of July to September inclusive. Sufficient water is applied to wet the soil down to a depth of 6 or 8 feet.

Peach orchards and the other stone-fruits on gravel-loam soils with only a medium water-holding capacity, are more frequently irrigated than apple orchards, and less water is applied at an irrigation. For the best production of peaches, it is especially desirable to have plenty of water available during the season following the hardening of the pit till harvest time. No amount of water during the early growing season will make up for lack of water during the month preceding the harvest. Early irrigation stimulates vegetative growth and thus causes an even greater demand for moisture later in the season than would otherwise be the case.

The fruit industry of Utah has undergone little or no boom when compared with some other sections. The steady, conservative growth of this industry seems reasonably certain, and future generations may see the horticultural crops of more relative importance than they are at present.

Utah is characterized, as a whole, by farmers owning their own farms, and the fruit industry is no exception to this rule. Land values have remained at conservative levels. The fruit-grower not only owns the orchard in which he works but usually has no desire to sell it.

Truck-gardening has only been locally developed around Brigham, Ogden and Salt Lake City. However, the canning factories have developed profitable and intensive production of tomatoes and peas in various sections throughout the state.

The cut-flower establishments around Salt Lake City and Ogden supply the local markets and export a quantity of flowers to the northwestern states.

Utah is especially free from insects and plant diseases harmful to fruit crops. The arid climate makes an uncongenial home for most of the fungous diseases and only the easily controlled fruit insects are prevalent within the borders of the state.

Very stringent horticultural laws promote the production of clean high-class fruit, as it is a misdemeanor in the state of Utah to sell, ship or offer for sale any fruit infested with insect or plant-disease blemishes.

Utah fruit enjoys a very favorable reputation among local and general markets. Utah Jonathan apples, Napoleon cherries, and Elberta peaches bring the top prices for these varieties, and compare favorably with similar fruit from other fruit-growing sections, wherever comparisons are made. Rich soils, the intense sunshine of an arid climate, and an abundance of irrigation water combine to produce fruit of the very highest quality and color.

Public-service agencies for horticulture.

The Utah Agriculture College is located in the northern part of the state at Logan in Cache County.

This institution was established in 1888. The horticultural staff consists of three teaching members.

The Agriculture Experiment Station, organized as a division of the College, has played an important part in helping the fruit-growers to solve their problems. The experimental staff has usually included at least one additional worker to the teaching staff mentioned above.

The following institutions in Utah teach one or more courses in fruit-growing to a large number of students of high-school and college grade: Utah Agriculture College Branch Normal School at Cedar City, Brigham Young University at Provo, Brigham Young College at Logan, Snow Academy at Ephraim, Murdock Academy at Beaver, and St. George Academy at St. George. With the exception of the first-mentioned, which is a state institution, the above schools were established and are now maintained by the Mormon Church. In addition to the above, every high-school in the state teaches at least one course in horticulture except schools located at Salt Lake City and Eureka.

The Utah Horticultural Society was formed in 1905 and has grown steadily in influence and value to the state since its foundation. A State Horticultural Commission was created in 1899, consisting of the Entomologist and Horticulturist of the Utah Agricultural College and three practical horticultural resident citizens of the state, one to be the Horticultural Inspector appointed by the Governor, and the other two to be appointed from the members of the State Horticultural Society.

Statistics (Thirteenth Census).

The approximate land area of Utah in 1910 was 52,-597,760 acres. The land in farms was 6.5 per cent of the land area, or 3,397,699 acres. Of this land in farms, the improved land numbered 1,368,211 acres; the woodland, 145,510 acres; and other unimproved land in farms, 1,883,978 acres. The total number of all the farms in Utah in 1910 was 21,676, and the average acreage to the farm, 156.7. [The total area is 84,970 square miles.]

The leading agricultural crops grown in Utah are hay and forage, cereals, and sugar crops. The acreage devoted to the production of hay and forage increased from 388,043 in 1899 to 405,394 in 1909, when the production was valued at \$7,429,901, which was 40.2 per cent of the total value of all crops. Cereals increased in acreage from 255,699 in 1899 to 298,613 in 1909, when the production was valued at \$6,092,281, or 33 per cent of the total value of all crops. Sugar crops increased in acreage from 7,917 in 1899 to 27,812 in 1909, an increase of 251.3 per cent, when the production was valued at \$1,871,478, or 10.1 per cent of the total value of all crops. Forest products of the farms were valued at 6,730 in 1909, as compared with \$13,325 in 1899.

Horticultural crops grown in Utah are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$671,165, as compared with \$291,902 in 1899. Small-fruits increased in acreage from 1,052 in 1899 to 1,416 in 1909, when the production was 3,118,395 quarts, valued at \$217,327. The total acreage of potatoes and other vegetables in 1909 was 21,216 and their value \$1,591,847. Excluding potatoes, other vegetables increased from 6,023 in 1899 to 7,006 in 1909, when the production was valued at \$717,776. Flowers and plants and nursery products increased in acreage from 250 in 1899 to 597 in 1909, when the production was valued at \$269,571.

The total production of orchard-fruits in 1909 was 633,739 bushels, valued at \$640,901. Apples contributed more than one-half of this quantity, and peaches and nectarines ranked next in importance. The apple trees of bearing age in 1910 numbered 517,039; those not of bearing age, 789,260. The pro-

duction in 1909 was 350,023 bushels, valued at \$319,691. Peach and nectarine trees of bearing age in 1910 numbered 544,314; those not of bearing age, 651,233. The production in 1909 was 143,237 bushels, valued at \$156,451. The production of the other orchard-fruits in 1909 was: 68,219 bushels of plums and prunes, valued at \$54,040; 21,402 bushels of cherries, valued at \$51,170; 38,654 bushels of pears, valued at \$44,365; 12,047 bushels of apricots, valued at \$12,037; and 118 bushels of quinces, valued at \$135.

The production of grapes in 1909 was 1,576,363 pounds, valued at \$28,126. Grape-vines of bearing age in 1910 numbered 201,445 and those not of bearing age, 91,013.

The production of nuts in 1909 was 16,649 pounds, valued at \$1,547. The nuts contributing to this quantity were 10,664 pounds of almonds, valued at \$1,014, and 5,985 pounds of Persian or English walnuts, valued at \$533. The production of tropical fruits was valued at \$588, of which figs produced \$576.

Strawberries are by far the most important of the small-fruits grown in Utah, with raspberries and loganberries ranking next. The acreage of strawberries increased from 345 in 1899 to 719 in 1909, when the production was 1,832,796 quarts, valued at \$125,854. Raspberries and loganberries increased in acreage from 284 in 1899 to 374 in 1909, when the production was 758,317 quarts, valued at \$54,826. Blackberries and dewberries increased in acreage from 72 in 1899 to 95 in 1909, when the production was 184,140 quarts, valued at \$13,447. Currants decreased in acreage from 194 in 1899 to 128 in 1909, when the production was 195,901 quarts, valued at \$13,435. Gooseberries decreased in acreage from 110 in 1899 to 100 in 1909, when the production was 147,241 quarts, valued at \$9,765.

Potatoes, the most important of the vegetables, increased in acreage from 10,433 in 1899 to 14,210 in 1909, when the production was 2,409,093 bushels, valued at \$873,961. Of the other vegetables grown, the more important were: 1,571 acres of tomatoes, valued at \$154,455; 210 acres of cabbage, valued at \$24,922; 323 acres of green peas, valued at \$18,810; 192 acres of cantaloupes and muskmelons, valued at \$16,917; 72 acres of onions, valued at \$13,394; 137 acres of watermelons, valued at \$12,232; 43 acres of celery, valued at \$10,835; 99 acres of asparagus, valued at \$10,645; and 120 acres of sweet corn, valued at \$8,842. Vegetables of less importance were green beans, beets, carrots, cauliflower, pop-corn, cucumbers, squash and turnips.

The acreage devoted to the production of flowers and plants increased from 14 in 1899 to 20 in 1909. The total area under glass in 1909 was 261,292 square feet, of which 249,280 were covered by greenhouses, and 12,012 by sashes and frames. The flowers and plants produced in 1909 were valued at \$81,116, as compared with \$34,173 in 1899.

The acreage occupied by nursery products increased from 236 in 1899 to 577 in 1909, when the products were valued at \$188,455, as compared with \$120,648, in 1899.

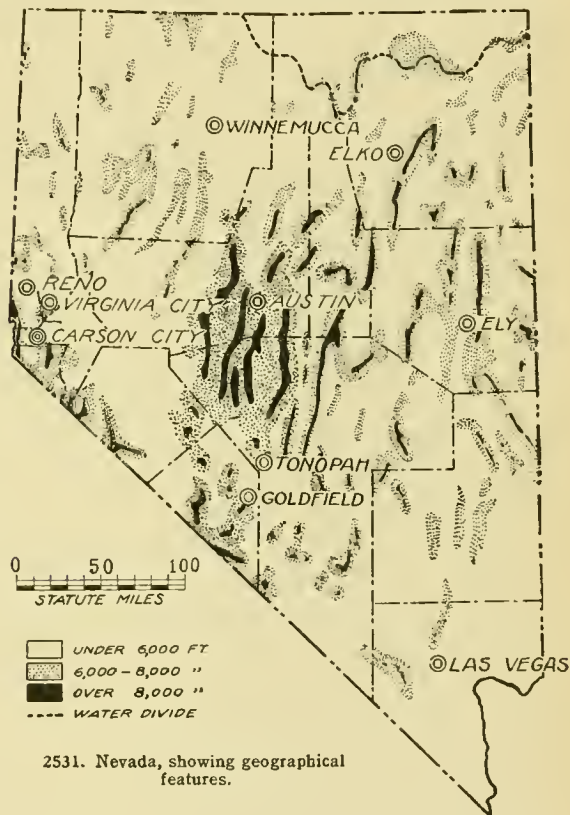
L. D. BATCHELOR.

Nevada.

Nevada (Fig. 2531) comprises the western half of the Great Basin or plateau situated between the Rocky and Sierra Nevada mountain ranges. The general elevation of this plateau varies from 4,000 to 6,000 feet. Within the limits of Nevada there are numerous parallel mountain ranges sheltering approximately 200 valleys.

The climate is comparatively mild and semi-arid. The annual precipitation at the base of the main ranges varies from 10 to 26 inches in the west to 15 inches in the east and is as little as 3 inches in the interior valleys. In southern Nevada, the annual precipitation is 5 to 7 inches. On the mountain ranges the maximum

winter precipitation in the form of snow reaches the water equivalent of 30 inches. Since two-thirds of the total annual precipitation occurs in the non-growing season, snow is the main dependence of the state for moisture on both range and farm, and is conserved by the mountains. Of these, the Sierra Nevada, Toyabe, Ruby, and Independence Ranges, three of which attain a maximum elevation of 11,400 to 14,500 feet, are the watersheds of the larger streams from which water for irrigation is derived. These streams, the Walker, Carson, Truckee, Reese, and Humboldt, traverse broad valleys and empty within the state. The Snake and the Colorado, on the northern



and southern borders, are of little economic importance. The Muddy and its tributary, the Virgin, which flow into the Colorado, supply a limited area in southern Nevada.

The mean annual relative humidity is only 50 per cent. The rate of evaporation from water surfaces relative to other parts of the United States is high. Although strong winds occur frequently, destructive or blasting winds are rare. The mean annual velocity of the wind at Reno is 7 miles an hour.

According to temperature, which determines the length of the growing season and the type of products, Nevada is divided into three main divisions: northern and western Nevada, central Nevada, and southern or subtropical Nevada. The mean minimum temperature in northern Nevada ranges from 33.1° F. in the west (elevation 4,500 feet) to 30.2° F. in the east (elevation 6,000 feet); and the mean maximum temperature from 67.4° F. to 60.8° F. In central Nevada (elevation above 6,000 feet), the mean minimum temperature is 31.5° F. and the mean maximum 60.6° F., a condition too precarious for other than home horticulture. In southern Nevada (elevation below 3,000 feet),

the mean minimum temperature is 48.9° F. and the mean maximum 81.9°.

An average of fifteen to twenty-five clear days and 74 to 89 per cent of sunshine occurs each month during the growing season. But intense radiation during the night diminishes somewhat the effect of the warm days. In northern Nevada, the growing season fluctuates from 77 to 168 days; in central Nevada from 52 to 139; and in southern Nevada from 130 to 240, the normal in each case lying midway between the two extremes. However, in the latter section the intense heat of the summer retards rather than accelerates growth.

The two great industries of the state are mining and agriculture, with a gross income for the former of approximately \$35,000,000 and the latter of \$15,000,000.

Irrigation is practised on approximately 90 per cent of the farms in Nevada, and little development of any source of water-supply other than streams has yet been made. Reservoirs still furnish only 5 per cent of the water used. The era of wells is just beginning. Dry-farming, which is necessarily limited to those parts of the state possessing a precipitation in excess of 12 to 15 inches, now embraces at least 4,000 acres.

Because of the preponderance of range land, forage crops have been greatly in excess of intensive crops and fruit, but seem now to have attained their highest acreage until the range is made capable of supporting a greater amount of live-stock, or until dairying and intensive stock-raising are established. The present (1915) value and relative importance of each is as follows:

Forage crops	\$5,488,250
Cereals	1,838,400
Intensive crops	1,125,000
Fruit	200,000

On the basis of the forage crops, the intensive and fruit crops represent a value of 20 and 3.6 per cent respectively.

Except in the matter of frost, Nevada is ideally adapted for the growing of fruit; the clear skies and cool climate aid materially in producing fruit of fine external appearance and unusually delicate flavor. In northern Nevada, apples, plums, pears, and the hardier cherries are readily grown, while southern Nevada is congenial to the growing of peaches, pears, apricots, pomegranates, figs, olives, quinces, grapes, and almonds. The growing of citrus fruits is effectually prevented by the temperature of 20° F. that regularly occurs in the winter and by an occasional drop in temperature to 10° or even 9° F.

Seventy per cent of the orchard-fruits and grapes grown in Nevada are produced in three counties: Washoe, in 1910, producing 49.5 per cent; Nye, 12; Elko, 8.5. Lyon and Churchill counties are coming into prominence as potential producers of fruit. All of the standard varieties of apples are found in Nevada.

The frequency and duration of frost varies with elevation. According to a temperature survey of Washoe and Churchill counties, the temperature has been found to vary 8° in a rise of 13.5 feet and only 9.5° in 250 feet, the average variation being probably not more than half of these amounts. It has been found that an increase in elevation of 250 feet is accompanied by a decrease in the number of occurrences of frost of fourteen to five in a season and a decrease in the duration of freezing temperatures from at least forty to sixteen hours.

In the bottom lands of northern and western Nevada, the fruit crop fluctuates approximately as follows: full crop one year in five; total failure one year in five; and three half crops. In the foothills, only one total failure has been recorded in twenty-five seasons. At one point, 1,000 feet above the valley, apricot and almond trees, unknown to produce fruit elsewhere in northern and western Nevada, grow secure from frost. On the

average, two heatings a season should save the Nevada crop, except in the coldest spots or in abnormal years.

The bench lands along the Sierra Nevada and the Ruby mountains compare closely in temperature with Provo, Utah, but are inferior to Grand Junction, Colorado. Furthermore, dry orcharding in these lands, as based on a five years' test, with an average annual precipitation of 13.61 inches, has proved successful, Ben Davis apples from the Elko County Dry Farm having received first prize at the State Fair in 1914.

The type of apple best adapted economically to Nevada is a late and long bloomer. Such is the so-called Nevada Sheepnose which has never been known to fail utterly. It is, moreover, a late keeper.

Most of the orchards and orchard land in Nevada are adjacent to railroads, but owing to the uncertainty regarding the crop, little effort is made to keep the orchards free from insect pests or to grade the fruit for marketing. Consequently, even the local markets are controlled largely by the California product. The orchards are usually small. Orchards of 20 to 50 acres are known, but these are very rare. The largest orchard is said to have 160 acres. Pears, plums, and cherries are grown only for family use.

In southern Nevada, apricots find a congenial environment because of the rainless weather at the time of ripening. Shipments of early fruit as well as the evaporated product find a ready market. For the same reason, and also because of a steadily increasing demand, almonds should be an ideal crop. Furthermore, the almond requires less moisture than most deciduous fruits.

The seedless grape industry is limited largely to acre tracts on each farm. One 50-acre vineyard is known. The grapes are shipped as raisins, but no attempt has been made to market them in carlots.

Of lesser fruits, the Mission and White Adriatic figs have been produced for years without a failure, and other varieties show especial promise. The Mission olives also "have withstood all extremes of temperature, and the few trees growing indicate possibilities of a new industry." Pears and quinces thrive in this climate, although the latter are not grown extensively. Peaches, especially the Elbertas, being short-lived, are grown only for home use.

In northern and western Nevada, raspberries, being late bloomers, are an unfailing crop. Currants and gooseberries are usually successful. Strawberries do well on the hill slopes. In southern Nevada, blackberries and dewberries are the most adaptable of the small-fruits; currants, gooseberries, raspberries, and strawberries are grown only with great care.

Owing to the scattered population and the control of the wholesale fruit industry by California companies, it will be difficult to increase the horticultural acreage, unless concerted action is taken to develop the home as well as the foreign market. However, the impending increase in the dairy industry with resultant increase in population should stimulate the fruit industry; and since fruit requires, after the root system is developed, from 25 to 50 per cent less water than farm crops, it seems probable that fruit-culture on the higher slopes may become an independent industry, particularly so if combined with other intensive agriculture such as the raising of bees and poultry.

Of intensive crops, potatoes seem to be the coming premier crop in Nevada. Of the 840,000 acres of land now under actual cultivation, at least 150,000 acres are said to be adapted to potato-culture. The Intermountain States, because of their porous soils, moderate summer temperature, and control of moisture through irrigation, are well adapted to the raising of excellent potatoes, and Nevada especially so because of its proximity to the markets of California and the low shipping rates via the Panama Canal to New York. Under fair cultivation, five tons or 170 bushels of potatoes to the

acre can be grown in Nevada, and under skilful cultivation the output can be increased to twelve tons. The average price is \$20 a ton, the price fluctuating between \$12 and \$25. Early varieties adapted to the state are Early Ohio, Rose Seedling, and Early Rose; the late varieties, White Pearl, Rural New Yorker No. 2, Perfect Peachblow, Great Divide, Burbank, and Peerless. The greater part of the potatoes grown in Nevada come from three counties, Lyon, Washoe, and Elko, the ratio in 1910 being 25.9, 25.7, and 8.5 per cent respectively. In southern Nevada, only early marketing is profitable, for potatoes do not keep well in that climate.

It is probable that the area of potato land can be further increased by the use of dry-farming on the higher slopes of the mountain valleys, where the conditions of rainfall and frost are much more favorable than in the center of the valleys below. The rainfall should be at least 12 inches and preferably 15 to 18 inches, and the slope free from frost after the first of May. The only serious pest is the celworm, a nematode gallworm, which causes some trouble. This parasite can be partially controlled by planting clean seed and rotating cereal crops with potatoes. Fall plowing and exposure of the soil to the hot sun has been suggested as a feasible method in Nevada where the winter cold is not sufficiently prolonged to destroy the eggs and larvæ.

The culture of onions is highly profitable if they are planted on the best soil, for the dryness and low temperature "make it comparatively easy to keep well-matured bulbs in inexpensive storage-houses until the market becomes favorable, which usually occurs after January 1, when the bulk of the California crop has been marketed." The best fields yield twenty tons an acre, and the normal price is \$20 a ton.

The soil of western Nevada is well adapted to the growing of sugar-beets, which attain a general average of 18 per cent sugar. A beet-sugar factory at Fallon (Churchill County) on the Truckee-Carson Project has a capacity of 65,000 tons per annum, but tariff conditions and the difficulty of establishing a local market for beet-sugar have so far seriously retarded the industry.

Since watermelons and cantaloupes are perishable, their commercial cultivation is dependent upon the quality of the product placed on the market. In northern Nevada, they mature late and consequently must come into direct competition with the produce of northern California. In southern Nevada, the cantaloupe is well adapted to the climate and is matured by the middle of July, after the season in Imperial Valley is over and before the season in Utah and Colorado has begun. Consequently, there is a potential market on either side. At present cantaloupes constitute the chief crop of Moapa Valley (Clark County) and vicinity. In 1913, \$80,000 or \$160 an acre was realized from their sale after transportation charges and commissions were paid. In 1914 the crop was 75 per cent larger, but owing to unfortunate markets the profits were less. The most serious drawback is the melon aphid which is difficult to control. The varieties of watermelons are Kleckley Sweets, Halbert Honey, and Florida Favorite, and of cantaloupes Emerald Gem, New Fordhook, and Rocky Ford.

Celery is still an experimental crop, and in northern and western Nevada, skill is necessary to carry it through the warm summer. The celery is of excellent texture and good flavor, and the crop, although limited, is so valuable that it is shipped even into California, where it sells at a higher price than the local product. Since much labor and care are required in securing a good product, there seems little prospect of over-production.

Asparagus thrives in both northern and southern Nevada and will grow in soils too alkaline for most other crops. Furthermore, little summer irrigation is required. In southern Nevada, it is a poor second to

cantaloupes as a commercial crop. It is marketed for six weeks in March and April in Chicago and other eastern cities. A canning factory is essential to care for the output after distant shipments are unprofitable.

The market and home gardens produce practically all of the vegetables grown in temperate climates, particularly beans, beets, cabbage, cauliflower, carrots, corn, cucumbers, garlic, kohlrabi, lettuce, onions, peas, pumpkins, radishes, squashes, sweet potatoes, rutabagas, tomatoes, and turnips. In southern Nevada, tomatoes ripen from late May until late November or December, the crop, however, being very light during the heat of summer. Commercial gardening in western Nevada is mainly in the hands of Italians, and the prices are reasonable. Except in southern Nevada, the market is local and is forced to compete to a certain extent with California. The winter-grown vegetables of southern Nevada find a parcel-post market in Salt Lake City. Lettuce has been shipped in earload lots, but the marketing of it has not always been successful.

Practically all the flowers and shrubs that are grown in the northern part of the United States, as well as the hardy perennials of California, grow well in northern Nevada. Peonies and bulbous plants bloom with only occasional injury from frost, and, owing to the lateness of the Nevada season, would find a ready market in California, if grown commercially. Owing to the dryness of the atmosphere, English holly does not thrive in this climate.

In southern Nevada, such semi-tropical plants as the oleander, the ornamental date palm, and weeping fan palm have been grown successfully. The bamboo and the pampas grass, which find a congenial environment in northern Nevada also, here grow to stately proportions, while the chrysanthemum supplies almost perfect blooms in the garden until after Thanksgiving.

Commercial greenhouse floriculture should be eminently successful, for the percentage of sunshine in the winter in Nevada is far in excess of that in California, and flowers can be grown in one-half the time.

Public-service agencies for horticulture.

The Agricultural College is situated at Reno and was established in 1888. It is an integral part of the University of Nevada. There is one member on the horticultural staff.

The Experiment Station is also at Reno and is a department of the University. The University and the Experiment Station possess two orchards, one exposed to frequent frosts, the other reasonably free from them. Two horticultural bulletins have been published, one on ornamental trees and shrubs, the other on the avoidance and prevention of frost.

A limited amount of extension work in horticulture is given. The Public Service Department of the University maintains an inspection service for plant insects and diseases, but not for fruit-grading.

Statistics (Thirteenth Census).

The approximate land area of Nevada in 1910 was 70,285,440 acres. The land in farms numbered 2,714,757 acres, or 3.9 per cent of the land area. The amount of improved land in farms was 752,117 acres; the amount of woodland in farms, 48,209 acres; and there were 1,914,431 acres of other unimproved land in farms. The number of all farms was 2,689 and the average acreage to the farm 1,009.6. [The total area of the state is 110,690 square miles.]

The leading agricultural crops of the state are hay and forage, and cereals. In 1909 the acreage devoted to hay and forage was 350,538, an increase of 20 per cent in acreage since 1899. The value of the production in 1909 was \$4,185,071, which was 70.7 per cent of the total value of all the crops. The acreage in cereals in 1909 was 34,958, as compared with 31,075 in 1899; the production in 1909 was valued at \$923,763, or 15.6 per

cent of the total value of all crops. The value of the forest products of the farms in 1909 was \$42,748, as compared with \$23,853 in 1899.

Horticultural crops grown in Nevada are fruits and nuts, small-fruits, vegetables, including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$97,128, as compared with \$16,752 in 1899, an increase in value of 479.8 per cent. Small-fruits decreased in acreage from 33 in 1899 to 37 in 1909, when the production was 50,287 quarts, valued at \$5,683. The total acreage of potatoes and other vegetables in 1909 was 6,822, as compared with 3,164 in 1899; the production in 1909 was valued at \$661,803. Vegetables, not including potatoes, increased in acreage from 924 in 1899 to 1,952 in 1909, when their products were valued at \$264,122. In 1909, 1 acre was devoted to flowers and plants and nursery products, as compared with 5 acres in 1899, and the value of the production in 1909 was \$2,113.

The production of all orchard-fruits in 1909 was 86,576 bushels, valued at \$82,695. This production was nearly six times as great as in 1899, when 15,287 bushels were produced. Apples are by far the most important orchard fruit, producing nearly seven-eighths of the total production in 1909, when 74,449 bushels of apples were produced, valued at \$66,097. The number of apple trees of bearing age in 1910 numbered 74,454; those not of bearing age, 16,868. The other orchard-fruits of any importance in 1909 were: 4,083 bushels of pears, valued at \$5,119; 3,857 bushels of plums and prunes, valued at \$4,654; 3,171 bushels of peaches and nectarines, valued at \$4,500; and 524 bushels of apricots, valued at \$1,418. In addition, cherries were produced to the value of \$894, and quinces to the value of \$13.

The production of grapes in 1909 amounted to 376,205 pounds, valued at \$12,045, as compared with 287,600 pounds, the production in 1899. The number of vines of bearing age in 1910 numbered 26,607; those not of bearing age 7,911.

The production of nuts and tropical fruits in Nevada is relatively unimportant. In 1909, almonds were produced to the value of \$606; Persian or English walnuts to the value of \$20. Of the tropical fruits, in 1909, 45,550 pounds of pomegranates were produced, valued at \$915; and 29,270 pounds of figs, valued at \$818.

Of the small-fruits, the raspberries and loganberries are the most important, with gooseberries and strawberries next in importance. In 1909 the production of raspberries and loganberries was 17,841 quarts, valued at \$1,901; that of gooseberries, 11,355 quarts, valued at \$1,317; that of strawberries, 11,189 quarts, valued at \$1,218; that of currants, 8,284 quarts, valued at \$1,083; and 1,078 quarts of blackberries and dewberries, valued at \$164.

The acreage devoted to the production of potatoes increased from 2,235 in 1899 to 4,864 in 1909, when the production was 766,826 bushels, valued at \$396,652. Of the other vegetables grown in 1909 the more important were: 399 acres of cantaloupes and muskmelons, valued at \$56,715; 124 acres of onions, valued at \$32,523; 37 acres of lettuce, valued at \$6,380; 43 acres of cabbage, valued at \$5,467; 27 acres of asparagus, valued at \$2,973; 34 acres of watermelons, valued at \$2,923; and 10 acres of tomatoes, valued at \$2,126. Vegetables of minor importance grown in 1909 were green beans, beets, carrots, cauliflower, celery, sweet corn, green peas, pumpkins, squash, and turnips.

There was 1 acre devoted to the production of flowers and plants in Nevada in 1909. The value of the flowers and plants produced from this 1 acre was \$1,620. The total area under glass in 1909 was 4,600 square feet, all of which was covered by greenhouses. The land devoted to nursery products in 1909 was less than an acre, and their value \$493.

J. E. CHURCH, JR.

PACIFIC STATES.

Washington.

The state of Washington (Fig. 2532) is naturally divided into two very different climatic areas. The slope on the west side of the Cascade Mountains is generally very rolling. The plains and mountain sections are usually covered with heavy timber. The elevation is from sea-level to 3,000 feet and mountain peaks extending to much greater elevations. The rainfall in the sections varies from 20 to 100 inches annually. The summers are generally warm and with very light rainfall. The winters are usually cloudy with a great deal of rain but with very little wind and cold weather.

The section of the state east of the Cascade Mountains is a broken elevated plain with mountains in the northern part of the state. The altitude varies from 500 to 3,600 feet, with mountains much higher. The rainfall varies from 5 inches in the lowest valleys to about 35 inches at elevations of 3,500 feet. There is practically no rainfall during the summer months and crop-production in the valley regions is developed almost entirely by irrigation. The temperature is equable and seldom reaches more than 16° below zero. The changes in temperature during the winter are usually gradual, and the extreme temperatures are seldom accompanied by wind.

The leading horticultural districts in the state are in the Yakima Valley, Wenatchee Valley, Spokane Valley, Okanogan Valley, and the lower Columbia Valley and the valleys of the Snake River. In the western part of the state the important horticultural districts are in Clark, Thurston, Pierce, King, and Whatcom counties.

Apple-growing is the leading horticultural industry in the state and in all probability will be for years to come. The fruit-growing sections producing apples in the largest quantities rank in the order named: Yakima Valley, Wenatchee Valley, Spokane Valley, Walla Walla district, Okanogan district, and the Clarkston district. The lower warm valleys grow the long-season apples, like Yellow Newtown and Esopus, to perfection, while the higher altitudes are best adapted to a shorter-season fruit, like the Wealthy and the Gravenstein. All apples color finely, and are very fair in appearance.

The greatest prune-growing area in the state is in Clark County. The Italian prune (Fellenberg plum) is planted in great numbers on both sides of the state. The French prune (Agen, Prune d'Agen, Petite, and the like), is planted in considerable numbers, but nothing like the Italian. Washington seems to be unable to compete with California in the production of this fruit. Nevertheless it is fairly profitable in Washington, yielding about the same number of pounds to the tree as the Italian, and selling in the eastern markets at a good price. But the Italian usually sells for more money, as the fruit is much larger. The Silver prune, or Coe plum (Coe Golden Drop), is a large, handsome prune when well prepared and always brings a good market price, selling for 2 or 3 cents a pound more than Italian or French. Not a great many are planted, and in some cases the prune-growers work their Silver prunes over to Italians. There are numerous varieties of prunes planted on the coast, but none in so great quantities as the Italian. Much of the fruit of this prune is shipped green, i. e., in a half-ripe condition. This finds its way to the most eastern markets, and some of it even to England. The fruit of the Italian stands shipment better than any other variety. Most large growers have evaporators in their orchards, and the most of the fruit is preserved in this way.

Pears are grown to great perfection in almost every part of the state, but there is no finer fruit than that which comes from the low warm valleys of the Snake, the Columbia, Walla Walla, and Yakima. The Bartlett

is the great summer pear, followed closely by Flemish Beauty. For fall and winter, Anjou, Clairgeau, Easter and Winter Nolis are largely grown.

In peach-growing, the Yakima Valley ranks first, with Wenatchee Valley second, and Clarkston third.

In the growing of grapes, the lower Yakima Valley and the Columbia River Valley in the central part of the state are taking the lead, with the Clarkston district a close second.

Sweet cherries grow to great perfection in all parts of the state, but especially so in the Puget Sound region and in the warm valleys of the east side. The sour varieties also grow and yield abundantly. Sweet cherries attain their greatest perfection in the warm valleys at an altitude not much above 1,000 feet. Sour varieties do best on the high lands, at an altitude of about 2,000 feet. Cherries have been found to be profitable, yet few new plantations are being set. The

make the crop profitable. Beans are grown in eastern Washington in great quantity. In the irrigated sections, this crop has not proved its capacity to adapt itself to the peculiar soil conditions existing. Celery can be grown in almost all sections of the state where the rainfall or water-supply is sufficient. There is a great deal of land in western Washington especially adaptable to this plant. Root crops, such as radishes, turnips, rutabagas, beets, carrots, and parsnips, do especially well. The plants of the crucifer family are very generally attacked by maggots and are difficult to grow to the highest degree of perfection unless planted extremely early or grown as an extremely late crop.

Seed-growing is a very important industry in Snohomish and Spokane counties. Large quantities of vegetable seed are grown in other districts also. The seeds grown in greatest quantity are garden and field peas, cabbage, cauliflower, beets, and turnips. Experimental work in bulb-growing is being conducted at Bellingham and promises to be the foundation for a large bulb industry.

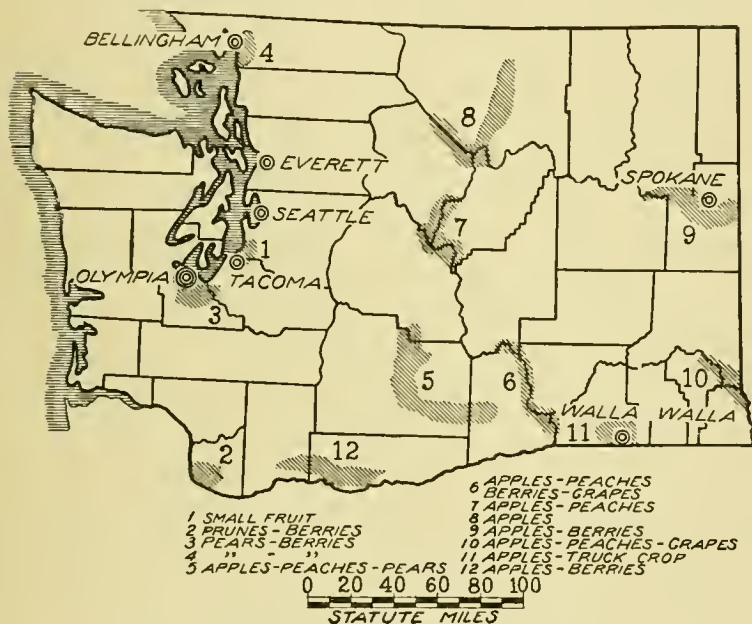
Great progress is being made in Washington in the establishment of fruit-product plants. There are several canning factories being very successfully conducted. Several of these are on cooperative basis. They do a regular canning business in fruits and vegetables and find especially profitable the making of strawberry mash and the canning of cherries, pears, and tomatoes. There are several vinegar factories in the state that use only the cheap or culled grades of fruit. There is one commercial plant manufacturing the unfermented fruit juice, paying special attention to grape juice.

The flowering plants ordinarily grown in gardens for commercial purposes do especially well in Washington. The rose probably does no better in any state in the Union than in Washington. Rose shows are very popular in the larger cities of the state. Sweet peas also reach a very high degree of perfection. Flower-culture, including the more common kinds for the home-garden,

is receiving a great impetus, as it has been neglected greatly in the past. Commercial florists' work is developing rapidly. The most common plants handled are the carnations, roses, chrysanthemums, ferns, and foliage plants. The city trade is usually supplied by the local houses. A great deal of attention is being given now to the production of bedding and border plant materials. Greenhouse establishments are increasingly popular for the production of flowers, but very little is done along the line of forcing winter vegetables. Transportation rates from the southern part of California are such as to prevent profitable vegetable-forcing work. The lowland valley districts are capable of producing crops of lettuce as late as the latter part of November and also of placing the spring crops on the market from the out-of-door beds as early as March.

The nursery business has been well developed in this state, but has fallen off greatly in the last three years. At present the nurseries are developing good stocks of ornamental plants and trade is rapidly increasing.

The most common pests to the general horticultural crops are codling-moth, bud-moth, apple- and peach-tree borers, San José scale and the various forms of aphids. There are many other insects making trouble in small localities. Of the plant diseases, pear blight, apple-scab, apple powdery mildew, anthracnose, or



2532. Washington, with distribution of horticultural crops.

reason for this is probably to be found in the labor market, it being almost impossible to get the necessary help to care for a large crop of cherries.

The greatest berry-growing section is in Thurston and King counties, Sumner and Puyallup being the centers. Bellingham, in Whatcom County, is the center of the berry and small-fruit district. Kennewick is the largest strawberry section east of the Cascade Mountains. Cranberry-growing is a new and rapidly developing industry in Pacific, Thurston, and Chehalis counties.

In the production of vegetables and truck crops the Walla Walla district ranks first, with Thurston and King counties second.

The vegetables that do well in cool weather are especially adaptable to wide planting in Washington and reach a very high measure of perfection. Lettuce, peas, onions, cabbage, cauliflower, kohlrabi, spinach, asparagus, and rhubarb do especially well. The warm-weather plants, such as tomatoes and sweet potatoes, are grown to the greatest perfection only in the lower altitudes. District above 1,500 to 1,600 feet are seldom able to mature tomatoes satisfactorily. The plant grows well and produces enormous crops of fruit in practically all sections of the state, but only the lower sections have sufficient length of growing season to

black-spot canker, and brown-rot are the most common. There are a few physiological diseases that appear in the orchards. Most of these seem to be due to lack of adaptation of the plant to the peculiar soil conditions of the district. The most common spray materials in use are lime-sulfur, bordeaux mixture, nicotine sulfate and crude-oil emulsion.

The large orchard planting in Washington has been induced by the great profit made by the owners of the oldest orchards in the state. Between 1901 and 1911, many orchards yielded crops that netted their owners profits of several hundred dollars an acre. Heavy orchard planting followed. The extremely high price received for the apple before 1912 still left good profits after deducting high freight rates. The increased crop and reduced price has made the marketing problem a very difficult one. The organization of coöperative selling associations began about 1907, although some small organizations were in operation before that date. The coöperative canneries were among the first to start and the first to fail. The Puyallup-Summer Fruit Association is one of the oldest and most successful organizations of its kind in the state. This organization owns and operates its own canning plant and handles approximately 95 per cent of the berry crop of that section. The organization is composed primarily of berry-growers. The Yakima Valley Fruit Growers' Association is a coöperative organization that sells fresh fruit only. This is the largest and one of the oldest local organizations in the state. There are now several similar organizations. The North Pacific Fruit Distributors is the largest coöperative organization in the state. It is composed of several affiliated local organizations. It is a selling agency only and does not attempt to do any of the work of the local organizations. Each local organization has its own brands and advertising methods and to a large extent its own set of rules for grading and packing. The f. o. b. sales at origin of the shipment are most desired by the grower, as the consignment shipments have very frequently failed to return a reasonable price to the grower.

Public-service agencies for horticulture.

The Land-Grant college of Washington is located at Pullman and was established in 1890. The institution is known as the State College of Washington. The Experiment Station is a department of the College and is located at the same place. At the present time there are seven men on the staff of the department, four doing college work only, and two connected only with the Experiment Station; the head of the department works in both College and Experiment Station. Since the establishment of the Experiment Station, fourteen bulletins have been published by the horticultural department. Several of these have been popular bulletins.

There are no special schools in this state teaching horticulture at the present time. Horticulture is taught in most of the high-schools in the state. Brief attention is given to it in the normal schools as a part of the agricultural course.

The extension work in horticulture is done by members of the Horticultural Department. Lectures, farmers' institutes, movable schools, and the conducting of correspondence courses in horticulture are the principal lines of activity.

The State Department of Agriculture has a subdivision of horticulture. The head of that division is known as Commissioner of Horticulture and all of the inspection work of the state is directly under his supervision. The state is divided into five inspection districts with district inspectors in charge.

The Washington State Horticultural Society is an organization of the fruit-growers of the entire state. Practically all of the members, however, reside east of the Cascade Mountains. The Western Washington Horticultural Society is an organization of the fruit-

growers residing west of the Cascades. The special interest of this society is for the promotion of the fruit-growing industry in western Washington. Fruit-growing unions and commercial organizations exist in every fruit-growing section of the state.

Statistics (Thirteenth Census).

The approximate land area of Washington in 1910 was reported as 42,775,040 acres. The land in farms was 27.4 per cent of the land area, or 11,712,235 acres. Of this land in farms, the improved land numbers 6,373,311 acres; the woodland, 1,541,551 acres; and other unimproved land in farms, 3,797,373 acres. The number of all the farms in the state in 1910 was 56,192 and the average acreage to a farm 208.4. [The total area is 69,127 square miles.]

The leading agricultural crops of the state are cereals, and hay and forage. The acreage of cereals increased from 1,350,897 in 1899 to 2,591,582 in 1909, when the production was valued at \$44,762,138, which was 56.7 per cent of the total value of all crops. Hay and forage increased in acreage from 497,139 in 1899 to 742,137 in 1909, when the production was valued at \$17,147,648, or 21.7 per cent of the total value of all crops. The value of forest products of farms was \$3,754,293 in 1909, as compared with \$1,002,126 in 1899.

Horticultural crops produced in Washington are fruits and nuts, small-fruits, vegetables, including potatoes, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$4,329,058, as compared with \$1,027,539 in 1899. Small-fruits increased in acreage from 2,845 in 1899 to 5,508 in 1909, when the production was 13,490,930 quarts, valued at \$941,415. The total acreage of potatoes and other vegetables in 1909 was 82,312 and their value \$5,982,665. Excluding potatoes, the acreage of other vegetables increased from 13,848 in 1899 to 24,410 in 1909, when the production was valued at \$2,988,510. Flowers and plants and nursery products increased in acreage from 189 in 1899 to 1,682 in 1909, when the production was valued at \$1,044,907.

The total quantity of orchard-fruits produced in 1909 was 4,244,670 bushels, valued at \$4,274,124. Apples contributed considerably more than half of this quantity and plums and prunes most of the remainder. The apple trees of bearing age in 1910 numbered 3,009,337; those not of bearing age, 4,862,702. The production of apples in 1909 was 2,672,100 bushels, valued at \$2,925,761. Plum and prune trees of bearing age in 1910 numbered 823,082; those not of bearing age, 122,912, and the production in 1909 was 1,032,077 bushels, valued at \$600,503. Pear trees of bearing age in 1910 numbered 290,676; those not of bearing age, 617,754, and the production in 1909 was 310,804 bushels, valued at \$328,895. Cherry trees of bearing age in 1910 numbered 241,038; those not of bearing age, 229,067, and the production in 1909 was 131,392 bushels, valued at \$278,547. Peach and nectarine trees of bearing age in 1910 numbered 536,875; those not of bearing age, 1,028,141, and the production in 1909 was 84,494 bushels, valued at \$118,918. Other orchard-fruits produced in 1909 were: 10,789 bushels of apricots, valued at \$17,280; and 3,008 bushels of quinces, valued at \$4,198.

The production of grapes in 1909 was 1,704,005 pounds, as compared with 1,194,700 pounds, the production in 1899. The value of the grapes produced in 1909 was \$51,412. The number of vines of bearing age in 1910 was 322,007; those not of bearing age, 371,733.

The production of nuts in 1909 was 65,441 pounds, valued at \$3,522. The more important of the nuts produced were: 16,450 pounds of English or Persian walnuts, valued at \$2,241; 43,438 pounds of black walnuts, valued at \$687; and 770 pounds of almonds, valued at \$86.

Strawberries are by far the most important of the small-fruits produced in Washington, with raspberries

and loganberries second in importance. The acreage of strawberries increased from 1,268 in 1899 to 3,283 in 1909, when the production was 7,683,774 quarts, valued at \$529,535. Raspberries and loganberries increased in acreage from 625 in 1899 to 1,210 in 1909, when the production was 3,118,720 quarts, valued at \$223,001. Blackberries and dewberries increased in acreage from 338 in 1899 to 769 in 1909, when the production was 2,340,779 quarts, valued at \$159,094. Other small-fruits produced were: 194,365 quarts of currants, valued at \$16,518; 143,264 quarts of gooseberries, valued at \$12,285; and 9,728 quarts of cranberries, valued at \$953.

Potatoes, the most important of the vegetables, increased from 25,119 acres in 1899 to 57,897 acres in 1909, when the production was 7,667,171 bushels, valued at \$2,993,737. Of the other vegetables grown the more important were: 934 acres of cabbage, valued at \$106,865; 415 acres of onions, valued at \$67,949; 364 acres of tomatoes, valued at \$62,613; 103 acres of celery, valued at \$39,686; 561 acres of sweet corn, valued at \$34,891; 352 acres of peas, valued at \$27,758; 194 acres of asparagus, valued at \$24,129; 310 acres of cantaloupes and muskmelons, valued at \$18,688; 214 acres of watermelons, valued at \$15,525; and 87 acres of turnips, valued at \$11,484. Vegetables of less importance were green beans, beets, carrots, cauliflower, cucumbers, lettuce, parsnips, radishes, rhubarb, rutabagas, spinach, and squash.

The acreage devoted to the production of flowers and plants increased from 34 in 1899 to 340 in 1909. The area under glass in 1909 was 1,539,972 square feet, of which 1,257,616 were covered by greenhouses and 282,356 by sashes and frames. The value of the flowers and plants produced in 1909 was \$518,226, as compared with \$50,450 in 1899.

Nursery products increased from 155 in 1899 to 1,342 in 1909, when the value of the nursery products grown was \$526,681, as compared with \$28,699 in 1899.

O. M. MORRIS.

Oregon.

Oregon (Fig. 2533) is a state of great extremes, the rainfall varying from as high as 130 inches down to a very few inches, in extreme seasons certain sections averaging as low as 2 or 3 inches, although 9 or 10 inches is generally the minimum. Along the coast, the annual rainfall averages about 70 inches, while in western Oregon between the Cascade and the Coast Range mountains, the rainfall varies from 25 to 45 inches. East of the Cascade Range, it varies from 20 inches down to about 9 inches.

There is also an extreme range of elevations. This difference varies from sea-level to the frost line. This line, with the exception of a few favored locations, is in the neighborhood of 3,000 feet, and this elevation is about the limit of successful fruit- and tender vegetable-production in this state.

The soils in the horticultural valleys tend to vary greatly and are very spotted; nearly all extremes are found. It is not uncommon to find twelve or fifteen distinct types of soil in one small valley. These soils will vary from the heaviest adobe, or so-called sticky soils, to the lightest volcanic ash or pumice-stone soils.

These changes in rainfall, elevation and soils, coupled with certain climatic factors, such as length of growing seasons, mean temperatures, extremes of heat and cold, give the state a very wide range of conditions. This means that a great many varieties of fruit can be grown successfully. While it is true, however, that each locality may be able to grow only a few varieties to the highest degree of perfection, yet there are very few varieties of deciduous fruit that are not found within the state.

Oregon can geographically be divided into two dis-

tricts,—western and eastern Oregon; the Cascade Range is the dividing line. Western Oregon, in turn, can be divided into two great districts, each of which can be further subdivided. The first great district extends between the Cascade and Coast Range Mountains and includes the Willamette, Umpqua, Rogue River, and other smaller valleys. The second district contains the area found west of the Coast Range Mountains and includes the coast counties of Coos, Lincoln, Tillamook, and so on.

East of the mountains several divisions can be made. First, there are those regions along the Columbia River and certain other parts of eastern Oregon which have a low altitude. These areas include such well-known districts as The Dalles, Hermiston and Free-water-Milton, which is a part of the Walla Walla Valley. Second, there are those regions which contain valleys of fairly high altitude, in the neighborhood of 2,000 feet, such as the Grand Ronde and certain areas in the vicinity of Vale and Ontario and a few of the interior valleys such as the John Day. The third district includes those regions found on the high tablelands. On the whole, this district is rather too bleak for successful commercial orcharding. There are, however, certain select parts along the streams and along certain of the lakes, like Summer and Goose lakes, that are splendidly adapted for fruit- and vegetable-production.

Hidden among the Cascade Mountains are found certain valleys which do not come in any of the classes already enumerated. These include such well-known regions as the Hood River and Mosier valleys.

In Oregon, fruit-growing is largely confined to valleys nestled among the mountains. Some of these valleys are very large; the Willamette Valley, for example, has 5,000,000 acres of tillable land. On the other hand many of the valleys are comparatively small, often containing only a few thousand acres.

The apple is the leading horticultural crop in Oregon and is being grown commercially in every horticultural section of the state. Within the last ten years, the planting of apples has gone forward on a tremendous scale and in the near future the output of this fruit should be enormous.

The prune is the second crop of horticultural importance in the state. East of the Cascade Mountains, it is grown in limited quantities for shipping green, while west of the mountains it is grown largely for evaporation purposes. The Italian (Fellenberg) prune is the principal variety grown, although a considerable quantity of French or Petite prunes are produced, especially in southern Oregon. There is an increased interest being shown in the prune within the last two years and new plantings have been very extensive.

The pear is rapidly coming to the front commercially. In certain sections, very large areas have been planted and the tendency all over the state is to increase the acreage devoted to its culture. At the present time the pear-growing areas are confined to certain sections of western and southern Oregon.

Sweet cherries are grown very extensively in western Oregon. The Willamette Valley excels in cherry-production, the Lambert doing especially well in that section, although the Royal Anne and Bing are grown commercially. Along the Columbia River, in the vicinity of The Dalles, the Royal Anne (Napolean Bigarreau) does extremely well. In the higher altitudes of eastern Oregon, the Bing becomes the leading variety. Few sour cherries except those produced for home purposes are being grown at the present time. This fruit, however, does remarkably well in the state and there is some inclination toward commercial plantings.

Peaches are grown largely as fillers, there being but very few sections of the state as yet that have a distinct peach industry. The nearest approach to this

condition is found at certain points along the Columbia, the Mission bottoms of the Willamette near Salem, and certain parts of the Rogue River Valley, especially at Merlin and Ashland.

In western Oregon, the principal developed horticultural regions are the Rogue River, the Umpqua, and the Willamette valleys. The Rogue River is rapidly becoming the pear center of the state. Large acreages of such varieties as Bartlett, Bosc, Winter Nelis, and Comice have been planted. In addition to the pear, extensive areas of apples, apricots and peaches are being grown. Grapes, especially of the vinifera type, such as the Tokay, Malaga and Muscat are receiving considerable attention.

The Umpqua Valley is rapidly developing into an apple district. Spitzenberg and Yellow Newtown are the leaders. Large areas of this valley, however, are devoted to the culture of French prunes, a few Italian

other varieties which are being grown commercially and, of late, considerable attention has been given to pears, such varieties as the Anjou, Comice, and Bartlett all doing well. This section is also famous for its strawberry-production, the strawberry being the principal crop grown among the young trees. A few miles east of Hood River is a small section known as the Mosier Valley which has conditions similar to those found in Hood River.

The Dalles district which is along the Columbia River, 22 miles east of Hood River, is becoming famous for its stone-fruits, and vinifera grapes. Royal Anne cherries, apricots, peaches, plums and prunes, Tokay, Malaga and Muscat grapes grow to a wonderful degree of perfection. This section is also producing large quantities of vegetables, especially tomatoes for table use.

The Freewater-Milton district, which is a part of the Walla Walla Valley, is characterized by the diversity of crops which it produces. This region is very early and is attracting particular attention because of its ability to put early fruits and vegetables into our leading city markets. Nearly all the fruit from this district is shipped fresh.

The Grand Ronde Valley in eastern Oregon, in Union County, has one of the largest areas planted to apples to be found in the state. Such varieties as York Imperial, Rome Beauty, Gano and Jonathan are being planted very extensively. At Cove, in this same valley, prunes and cherries predominate. The Bing cherries from this district are famous because of their splendid shipping qualities.

There are many other valleys in the state which are producing fruit, but as yet only in small quantities. Some of these districts, such as the Pine Valley, Eagle Valley, John Day Valley, and a few regions in the vicinity of Ontario and certain select parts in proximity to Summer undoubtedly develop their horticultural possibilities very extensively in the near future.

and Goose lakes, will

Oregon is developing a very large nursery business. In fact, one of the largest nurseries in the United States, namely the Oregon Nursery Company, is located at Orenco. This nursery has 1,000 acres planted to nursery stock at Orenco besides plantings in other parts of Oregon. There are also a number of smaller nurseries located throughout the state. Most of these, however, are in western Oregon in close proximity to Portland.

Among the unusual crops which are being grown in the state should be mentioned the English holly. A large number of persons are planting out this tree commercially. The tree thrives especially well in the rolling foothill country of western Oregon.

The cranberry is produced in this state very successfully and in all the coast counties limited areas of cranberry land can be obtained. Up to the present time, all bogs established have proved themselves very productive and have shown great promise for the future.

The loganberry is rapidly becoming one of the leading horticultural crops and the indications are that within the next ten years it may surpass in output all the other horticultural crops in the state. West of the Cascade Mountains there are large areas adapted to this fruit. It is very productive and, having so many uses, is meeting with a brisk demand. It is canned for sauces



2533. Oregon, with the main horticultural parts.

SCALE OF MILES
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prunes, and a scattered planting of almonds and English walnuts. The region is extremely early and some attention is being given to the production of early fruits and vegetables.

The Willamette Valley, which is the largest horticultural valley in the state, is the center of the Italian prune, sweet cherry and the English walnut industry. In addition to these crops, large areas have been planted to both apples and pears. At the present time there is a revival of interest in the pear and a large acreage devoted to this fruit is being established. The loganberry output at the present time is largely centered in the Willamette Valley. The valley is so large and has so many varied conditions that its horticulture is becoming greatly diversified.

Along the coast, small-fruits grow to the highest degree of perfection and this is especially true of the brambles. The coast districts are also producing apples commercially, such varieties as the Gravenstein and King of Tompkins County growing particularly well. Coos Bay, from a horticultural point of view, is the leading section.

Along the Columbia River, in the heart of the Coast Range Mountains, is the Hood River Valley. This valley is unsurpassed in the grade of Spitzenberg and Yellow Newtown apples which it produces. There are

and pies, evaporated, made into jellies and jams, and produces a most excellent beverage similar to grape-juice.

Broccoli-growing is beginning to attract a great deal of attention. This crop is very easily grown and can be harvested during the winter, and in the very near future large shipments will be sent out of the state. A large area of land along the Columbia River and in the coast counties, and certain districts west of the Cascades, are adapted for this crop.

The onion is becoming one of the leading vegetable-gardening crops and is confined to certain sections of western Oregon which contain what is known as the Beaverdam soils. Many carloads of onions are shipped out of the state annually.

Some attention is being given to ginseng-growing, although as yet this industry is still in its infancy.

Since Oregon has few large cities, park systems of great importance have not been developed. However, the smaller towns and cities are growing very rapidly and many of them are establishing splendid foundations for future development. There are farms of vast acreage, but very few private estates have been developed as country homes.

The first fruit brought into the Northwest was introduced by the Hudson Bay Company in 1824. A group of young men who were about to sail from England for Vancouver were attending a banquet, and the young women present saved the seed from the apples eaten on the occasion, and gave them to the young men to plant in the new country. These seeds were eventually planted and the resultant grove of trees produced the first apples grown on the Pacific coast. In 1847, Henderson Lewelling and William Meek brought across the prairies from Iowa several thousand and grafted sprouts, a few trees and a large quantity of seed. With this stock they established the first nursery in the state at Milwaukee. Ralph C. Geer, in the same year, also brought seed from the East and planted it. All these men were closely associated with the horticultural development of the state and, together with Seth Lewelling, were instrumental in its inception.

Seth Lewelling produced some of our finest varieties of fruit. Among these are the Bing and Black Republican cherries, which were produced in the sixties, and the Golden prune produced in 1876. J. H. Lambert in 1896 presented the Oregon State Horticultural Society with the Lambert cherry. This variety is probably the finest cherry grown in America, and is rapidly becoming our leading shipping sort. A. I. Shippley for years was identified with the grape industry, and was responsible for the introduction of many varieties which are now being grown commercially. Mr. Pettyman introduced the Oregon cherry, which is now being grown on a commercial scale in various parts of the state. Cyrus Hoskins brought out the Hoskins, Vesta and Lake cherries. They are very good, and superior to many now grown in America, but, owing to the introduction of the Bing and Lambert, have not been planted extensively. The Major Francis cherry, one of our best early varieties, was introduced by G. W. Walling, of Portland.

Other varieties of fruit of commercial importance which have been introduced by Oregon are the Winter Bartlett pear, Willamette and Pacific prune, Early Charlotte peach, Vanderpool Red apple, Clark Seedling, Gold Dollar, Magoon and Oregon strawberries.

Public-service agencies for horticulture.

Under the Land-Grant Act of 1862, Oregon was granted 90,000 acres of land. There was no state college in Oregon in 1868. The Legislature that year provided for the location of the land received and gave the interest on funds derived from the sale of the land to the Corvallis College, a private institution in Benton County, which was then under the control of the Methodist Episcopal Church. In 1885, the church voluntarily

relinquished its claim on the College, and the State assumed entire control of the institution, which then became known as the Oregon Agricultural College. There are at present fourteen members of the horticultural staff.

The Experiment Station is also located at Corvallis. There are fifteen men giving part or all of their time to horticultural research work. Two of these men are located at Talent, in southern Oregon, where 20 acres of land are being devoted to pear-production problems. In Hermiston, eastern Oregon, three men are studying fruit-production problems under irrigated conditions, 40 acres of land being used for these problems. One man is located at Hood River, Oregon, investigating special apple problems. Forty-three bulletins on horticultural subjects have been issued in addition to circulars.

The College is also paying considerable attention to extension work, one man devoting his entire time to extension work in pomology.

There are no other institutions in the state giving instruction in horticulture. There is one correspondence school known as The Pacific Horticultural Correspondence School located at Orenco. Considerable attention is being given in the state to work in school-gardens and children's club work in horticulture. Other than this, however, there is very little horticultural teaching done, with the exception that in a few high-schools courses have been introduced.

The Oregon State Horticultural Society is the leading society of its kind in the state. There is a special State Board of Horticulture consisting of five commissioners, the state being divided into five horticultural districts and one commissioner having charge of a district. In most of the counties will be found County Fruit Inspectors under the jurisdiction of a commissioner. The duties of the Board of Horticulture consist largely of police duties, enforcing horticultural laws on spraying, quarantine, and so on.

Statistics (Thirteenth Census).

The approximate land area of Oregon in 1910 was 61,188,480 acres. The land in farms was 11,685,110 acres, or 19.1 per cent of the land area. Of this land in farms, 4,274,803 acres were improved land; 2,237,826 acres were woodland, and 5,172,481 acres other unimproved land in farms. The number of all the farms in 1910 was 45,502, and the average acreage of each 256.8. [The total area is 96,699 square miles].

The leading agricultural crops of Oregon are cereals, hay and forage and hops. The acreage of cereals increased from 1,222,648 in 1899 to 1,242,300 in 1909, when the production was valued at \$17,860,136, which was 36.4 per cent of the total value of all crops. Hay and forage increased in acreage from 731,823 in 1899 to 939,979 in 1909, when the production was valued at \$15,225,957, which was 31 per cent of the total value of all crops. Hops increased in acreage from 15,433 in 1899 to 21,770 in 1909, when the production was valued at \$2,838,860. The value of forest products of the farms in 1909 was \$2,889,991, as compared with \$1,300,724 in 1899.

Horticultural crops produced in Oregon are fruits and nuts, small-fruits, potatoes and other vegetables, and flowers and plants and nursery products. The value of the fruits and nuts produced in 1909 was \$3,452,205, as compared with \$1,071,129, in 1899. Small-fruits increased in acreage from 3,470 in 1899 to 5,122 in 1909, when the production was 9,348,490 quarts, valued at \$611,194. The total acreage of potatoes and other vegetables increased from 46,407 in 1899 to 67,399 in 1909, when the value of the production was \$4,548,523. Excluding potatoes, the acreage of other vegetables increased from 16,345 in 1899 to 23,129 in 1909, when the value of the production was \$2,448,917. Flowers and plants and nursery

products increased in acreage from 1,072 in 1899 to 2,298 in 1909, when the production was valued at \$1,051,853.

The total production of orchard-fruits in 1909 was 4,423,244 bushels, an increase of 190.6 per cent over the production in 1899. Apples were the most important of the orchard-fruits, with plums and prunes second in importance. The number of apple trees of bearing age in 1910 was 2,029,913; those not of bearing age, 2,240,636, and the production in 1909 was 1,930,926 bushels, valued at \$1,656,944. The plums and prune trees of bearing age in 1910 numbered 1,764,896; those not of bearing age, 427,609, and the production in 1909 was 1,747,587 bushels, valued at \$838,783. Pear trees of bearing age in 1910 numbered 273,542; those not of bearing age, 795,669, and the production in 1909 was 374,622 bushels, valued at \$366,977. Cherry trees of bearing age in 1910, numbered 223,456; those not of bearing age, 313,770; and the production in 1909 was 181,089 bushels, valued at \$269,934. Peach and nectarine trees of bearing age in 1910 numbered 273,162; those not of bearing age, 508,179; and the production in 1909 was 179,030 bushels, valued at \$194,314. Other orchard fruits produced were 4,616 bushels of apricots, valued at \$7,727, and 5,354 bushels of quinces, valued at \$5,140.

The production of grapes in 1909 was 3,206,874 pounds, valued at \$98,776. The vines of bearing age in 1910 numbered 381,302; those not of bearing age 468,598.

The production of nuts in 1909 was 177,632 pounds, valued at \$13,208. English or Persian walnuts are the most important nut, the production in 1909 being 79,060 pounds, valued at \$8,288. The English walnut trees of bearing age in 1910 numbered 9,526; those not of bearing age, 177,004. Other nuts produced in 1909 were: 17,515 quarts of almonds, valued at \$2,468; 69,097 pounds of black walnuts, valued at \$1,333; and 5,731 pounds of chestnuts, valued at \$599.

Of the small-fruits, strawberries are the most important in Oregon, with raspberries and loganberries ranking next. The acreage devoted to strawberries increased from 1,792 in 1899 to 2,941 in 1909, when the production was 5,322,040 quarts, valued at \$395,349. Raspberries and loganberries increased in acreage from 479 in 1899 to 1,460 in 1909, when the production was 2,644,948 quarts, valued at \$150,729. Blackberries and dewberries decreased in acreage from 717 in 1899 to 431 in 1909, when the production was 915,744 quarts, valued at \$61,066. Other small-fruits produced were: 307,395 quarts of gooseberries, valued at \$20,893; 117,354 quarts of currants, valued at \$9,452; and 40,864 quarts of cranberries, valued at \$3,527.

The acreage of potatoes increased from 30,035 in 1899 to 44,265 in 1909, when the production was 4,822,962 bushels, valued at \$2,098,648. Of the other vegetables produced the more important were: 721 acres of onions, valued at \$168,261; 591 acres of cabbage, valued at \$65,296; 203 acres of tomatoes, valued at \$39,060; 568 acres of watermelons, valued at \$32,842; 198 acres of cucumbers, valued at \$22,825; 457 acres of sweet corn, valued at \$21,371; 113 acres of cantaloupes and muskmelons, valued at \$14,337; 24 acres of celery, valued at \$14,290; and 50 acres of horse-radish, valued at \$13,576. Vegetables of less importance grown in Oregon in 1909, were asparagus, green beans, beets, carrots, cauliflower, pop-corn, lettuce, parsnips, rhubarb and squash. The whole range of temperate vegetables can be grown in the state.

The acreage devoted to the production of flowers and plants increased from 58 in 1899 to 130 in 1909. The total area under glass in 1909 was 716,543 square feet, of which 672,207 were covered by greenhouses, and 44,336 by sashes and frames. The value of the flowers and plants produced in 1909 was \$268,833.

The acreage of nursery products increased from

1,014 in 1899 to 2,168 in 1909, when the value of the nursery products was \$783,020, as compared with \$151,498 in 1899.

C. I. LEWIS.

California.

The horticultural resources of the state of California (Fig. 2534) can best be understood by a careful and thorough study of its geographical features, preferably by a contour map. Its more striking features consist of a rugged coast-line of a thousand miles on the ocean; a rugged, much-broken group of interlocked mountain chains, forming, as a whole, the great Coast Range, with its fertile valleys, plains, uplands, forests and pastures; a vast interior valley-plain, one of the richest in the world (the Sacramento and the San Joaquin valleys); the high Sierra Nevada Mountains along the north-east and east sloping down to the deserts, the Death Valley, and Salton Sink. This great region has marked unity and individuality, a multitude of local climates, much variety of soil and rainfall, and physical conditions which strongly differentiate it from the remainder of the United States. Its length north and south is 780 miles, and its width is from 150 to 350 miles. It is the second largest state in the Union, and the value of its staple horticultural products places it notably in the lead in these industries. New York, Ohio, Maine, New Jersey, Vermont, Massachusetts, New Hampshire, Connecticut, Delaware, and Rhode Island, united, have a less area than California.

The range of products grown in California is greater than that of all the remainder of the United States; the humid sea-level islands of Florida are adapted to some plants, such as cassava, which thrive but poorly in California, but on the sheltered uplands of California many species which entirely fail in Florida are perfectly at home.

In many places in California, a botanical garden might easily be established where a greater number of species of plants and trees would thrive than have yet been brought together anywhere else in outdoor culture. The United States Bureau of Plant Industry has now (1915) test-gardens in various places as far north as Chico, where many species of exotics are thriving. In ordinary cultivation in California one finds, and often on an enormous scale, the vines, walnuts and prunes of France; the olives, oranges, lemons, chestnuts, figs and pomegranates of Italy and Spain; the acacias, eucalypts, casuarinas and salt-bushes of Australia; the melons of Turkestan; the rice of China; the cotton and tobacco of the South; the hemp, flax, rye, Russian mulberries, and other products of the more extreme North, the cereals of the great West, the bulbs of Holland, the costly seed-crops of European gardens, and, in brief, examples of all the useful horticultural productions of the temperate zones, together with the greater part of the species of the semi-tropical and even some plants from the tropical regions. More than a hundred species of palms grow at Santa Barbara; many species of bamboo thrive at Bakersfield, and as far north as the base of Shasta. Eucalypts, acacias, camphor and cinnamon grow over the greater part of the state.

While the American pioneers of Kentucky were fighting the Indians and struggling to obtain the right to navigate the Mississippi, the Spanish pioneers of California were raising seedling peach, pear, lemon, orange and date-palm trees, were growing figs, grapes, and olives from cuttings brought from Mexico, and were making marvelous beginnings of horticulture about the early missions. After the American conquest, and the gold discovery of 1848, horticulture gained a foothold in the mountain lands below the Sierra peaks. Every village and town had its gardens and its beginnings of orchards. Soon the thoughts of men turned to the broad, fertile, untitled valleys, and in a few years the wheat farmer became the typical Californian.



LXXIV. North American horticulture.—Foothills orchards in California.

Lastly, the state entered upon a magnificent and still-continuing period of horticultural developments, which well deserves to be written down in history as one of the most important facts of modern material progress.

Horticulture in California naturally divides itself into several distinct historical periods, such as: (1) The pre-American era, which ended with the gold discovery; (2) the pre-railroad period, when only California and to a small extent the Hawaiian Islands, the Orient and South America, were supplied with local products; (3) the period of expansion due to the opening of eastern and European markets by the railroad; (4) the modern period, since 1904, when the National Forest System, the conservation of water-supply, the rapid development of hydro-electric power all over the mountain regions of California, the extension of markets, rapid increase in population, and broader horticultural education, have united to establish every industry connected with plant life upon a more solid foundation.

Because of these recent developments in California, forests, pastures, farms, gardens, so suggestively occupy the land that, although there is room for many more, it is difficult to call anything horticulturally worthless except the great heights that shelter and water the valleys below. Even the deserts have underlying streams, and blossom with trees and vines as men sink artesian wells there; and on the unirrigated deserts the spineless cacti begin to create a new industry. The miracles of Italy, ancient Palestine, modern India, are being repeated over large districts of California.

The great valleys and nearly level lands of California, subject to frosts, comprise about 40,000,000 acres of land; the foothill fruit-belts, of Coast Range and Sierra, hardly as yet one-fifth occupied, comprise fully 25,000,000 acres; in timber and fine grazing land, capable of perpetual renewals, are 15,000,000 acres; high mountains cover some 10,000,000 acres; arid lands, often yielding enormously under irrigation, or slowly conquered by neutralizing their superabundant alkali, occupy about 8,000,000 acres. Over these great areas every wind current, every mountain spur, every alteration in slope or altitude, helps to make a local climate. The complicated geological development of California has produced soils almost as varied as its local climates. The state has been divided into five characteristic climate-zones: in the high Sierras the "mean annual temperature" is from 30° to 44°; in the lower Sierras it is from 44° to 52°; near the Pacific Ocean it is from 52° to 67°; in the central valleys of Sacramento and San Joaquin it is from 60° to 68°, and in the southern counties from 68° to 72°. But every part of California shows very sharp horticultural contrasts; upon farms not a mile apart. Local climate is the true keynote of California life. Placer County, for example, extends from the center of the Sacramento Valley east to the summit of the Sierras. It has upland Canadian valleys, pines and snow-blockades at one end; groves of oranges and lemons in the Sierra foothills, and rich alfalfa and rice fields along the "bottoms" of the Sacramento Valley rivers. Too much emphasis cannot be placed upon this local variation. For California no reliable horticultural map can yet be made. Citrus fruits, for example, are found to thrive wonderfully along the foothills of the Sacramento and the San Joaquin valleys, and far up in many a mountain valley. The most careful experimenting with each location, and indeed with all parts of each separate farm, are the keynotes of success in California.

"Mean annual temperature" is a comparatively small factor in the California climate; winds, fogs, rainfall, frosts, and the daily variations of temperature are the all-important items.

It is now evident (1915) that the growth of citrous fruits, European grapes, olives, walnuts, chestnuts, and the finer deciduous fruits, will be leading industries over three-fourths of California; that large portions of the valleys of the Coast Range and some of the Sierra foothills will increasingly produce winter vegetables, small-fruits, the finer seeds, bulbs, cut-flowers, and the like; that the hotter, more arid districts will grow date palms, spineless cacti, the earliest melons, and many tropical fruits. In these respects Imperial Valley has been a revelation of immense possibilities.

Statistics are often dull reading, but are necessary if one would comprehend the growth of horticulture, especially fruit products, in California. The raisin industry, which began in Yola County with the Blowers' experiments, grew by 1873 to a yield of 120,000 pounds, now centers in Fresno, Tulare, Kings, and Madera counties, and supplies from 60,000 to 80,000 tons per annum. The wine industry now markets annually about 45,000,000 gallons (1910). The shipment of



2534. California, to show the leading horticultural parts. 1, North coast; 2, central coast and coast valleys; 3, great interior valleys and lower foothills; 4, higher foothills and mountains; 5, arid plateaus and mountains; 6, southern coast; 7, southern foothills; 8, irrigated desert areas; 9, southern desert.

fresh deciduous fruits in 1911 above the supply of local demand, approximated 13,000 carloads; the shipments of cured fruits in 1911 were nearly 190,000 tons; the citrous fruit crop of that year was 14,000,000 boxes. The annual pack of canned fruits and vegetables is not less than 5,000,000 cases. Shipments of 1910 were 73,745 tons of canned fruits and vegetables and 78,829 tons of green vegetables, besides local consumption.

The growth of these interests can also be illustrated by the census reports on trees and vines. The first assessor's tabulations in 1850 showed a few dozen grape-vines, orange trees, and the like, about the old missions. In 1893, these reports showed that nearly half a million acres were in vineyards and orchards; seventeen years later (1910) the State Board of Equalization report of vines was as follows:

Class of fruit	Acreage bearing	Acreage non-bearing
Grape, table	35,859	17,970
Grape, raisin	108,882	19,385
Grape, wine	125,109	35,518
Total acreage of vines	269,850	72,873
Total of all vines	342,723 acres	

In 1914, the state had nearly 1,200,000 acres in orchards.

The five leading counties in their acreage of table grapes are San Joaquin, Fresno, Sacramento, Tulare and Placer. In raisin grapes, Fresno greatly leads, with Kings second, and Sutter third. Fresno, Napa and San Joaquin lead in wine grapes; Santa Cruz, Sonoma and Mendocino have the greatest number of apple trees; Santa Clara, Kings, Alameda and Ventura of apricots; Fresno, Kings, Placer and Santa Clara, of peaches; Fresno and Los Angeles of figs; Fresno and Placer of nectarines; Los Angeles, Riverside and Tehama of olives; Santa Clara, Sonoma and Placer, of plums and prunes; San Bernardino, Los Angeles, Riverside and Tulare of citrus fruits.

In recent years, the nursery business has been greatly extended, particularly in southern California, where the demand for rare plants and trees is constantly increasing.

Active clubs and associations of florists, gardeners, nurserymen, and amateurs interested in horticulture exist in various parts of California. In Ventura, Santa Barbara, the Lompoc Valley, Pasadena, Whittier, Santa Ana, Pomona, Riverside, and over a large area around Los Angeles, also in Santa Clara, Alameda, Marin, Sonoma, and other counties, many of the lesser horticultural industries are gaining strength year by year, as population increases.

The growth of parks, fine estates, and horticultural collections of note, while not as yet developing into a really great botanic garden, such as California should have, has still been noteworthy. The Golden Gate Park of San Francisco, the parks and public squares of Oakland, San Jose, Sacramento, Fresno, Los Angeles, Riverside, Pasadena, Redlands, San Diego, and many other cities, are becoming of much interest and importance. The beauty and, indeed, the splendor, of thousands of superb private estates around San Francisco, north, south, and on the east side of the Bay, in Santa Cruz and Monterey, and in southern California, have achieved a world-wide fame. Of especial importance are the Bidwell collections at Chico, the Gillespie arboretum at Montecito, Smiley Heights at Redlands, the Del Monte gardens near Monterey, the Stanford plantings at Palo Alto, the Tevis bamboos near Bakersfield, the collections of Dr. Pierce at Santa Ana, the government plant-gardens at Altadena, Chico, and other points, and the University of California stations at Berkeley and Santa Monica.

One of the most impressive facts connected with California horticulture is the extent to which state and national study of the problems involved has resulted in better methods and more complete organization. The citrus industry in particular has greatly profited from the investigations made by experts upon cultural methods, packing details, and so on. The University of California, the Experiment Station and institute work, have everywhere taught scientific methods and organization, until now (1912) the effectiveness of the fruit exchanges, and the general interest in the movement toward complete standardization of methods and products is everywhere increasing. One of the greatest factors in this progress is the State Horticultural Commission, formerly the State Board of Horticulture.

California has had many horticultural publications, large and small; some of them continue, and others enter the field every year. The Pacific Rural Press, although

not horticultural in name, has presented the horticultural adaptabilities from its foundation in 1870, under the editorship of Professor Wickson. The official literature, state and national, and the mass of reports upon its horticultural industries which envoys from other countries have issued, is very large indeed.

The most striking single fact, however, in regard to California horticulture appears to be that since 1900 it has shown a marked tendency toward systematic organization and the most painstaking scientific study of its problems, to the end that as new horticultural centers develop, and older ones increase, each community will specialize according to its local resources. At the present time (1912) a committee of nurserymen are collecting and tabulating all available facts in regard to the percentage of trees which reach profitable bearing under different conditions, and in different localities. A similar spirit of investigation extends to all the minor horticultural industries, so numerous and so rapidly increasing in importance with a growing population. The planting of eucalypts on a large and widely-advertised scale, has lessened, but still goes on. Acacias are being planted, to some extent, for tanbark, and bamboos for furniture.

The horticultural development of California has come in large measure from the tireless efforts of many and hard-working pioneers in every department. Nurserymen and gardeners like Fox, West, Rock, Lewelling, Sievers, spent their profits in experiments and introductions. Men and women like E. L. Beard, General John Bidwell and his wife, J. DeBarth Shorb, of San Gabriel, Mrs. Jeanne C. Carr, Mrs. Theodosia B. Shepherd, of Ventura, Mrs. M. E. Sherman, and many others, did noble pioneer work.

Public-service agencies for horticulture. (W. T. Clarke.)

The Land-Grant College is situated at Berkeley, and was established in 1868. The horticultural staff consists of thirty members. Aside from the usual equipment, the department has about 100 acres in the central and northern part of the state devoted to orchard purposes, and 200 acres devoted to the same purpose at the Riverside Citricultural Station.

The Experiment Station is also located at Berkeley, although the larger part of the work is done at the farm at Davis, the Kearney farm near Fresno and at the Riverside Station. A small amount of work is also done at the Imperial Valley Station, near Meloland. About 160 horticultural bulletins and 62 circulars have been issued.

Extension work in horticulture is given in connection with farmers' institutes, movable or extension schools and agricultural rural improvement clubs. An extensive correspondence is also carried on by the department.

Horticulture is taught in many of the public schools.

Statistics (Thirteenth Census).

The approximate land area of California comprises 99,617,280 acres, of which 27,931,444, or 28 per cent, are in farms. Of these 27,931,444 acres in farms, 11,389,891, or 40.8 per cent, are unimproved; 4,541,767 acres are in woodland; and 11,999,783 acres are unimproved. The total number of farms in the state is 88,197. The average acres to the farm are 316.7. [The total area of the state is 158,297 square miles.]

The leading agricultural crops are cereals, hay and forage, hops, sugar crops, and forest products. The cereals occupied 17.3 per cent of the improved land, or 1,970,492 acres, in 1909, a decrease in acreage of 50.8 per cent since 1899, when they occupied 4,004,254 acres. The value of the cereal products in 1909 was \$28,039,826. Hay and forage occupied 22.2 per cent of the improved land area in 1909, or 2,533,347 acres, an increase in acreage of 13.1 per cent since 1899, when they occupied 2,239,601 acres. The value of hay and forage in 1909 was \$42,187,215. The acreage of hops increased from

6,890 in 1899 to 8,391 in 1909, an increase of 21.8 per cent. The value of hop products in 1909 was \$1,731,110. Sugar crops increased in acreage 92.1 per cent,—from an acreage of 41,382 in 1899 to 79,604 in 1909. The value of the sugar crops in 1909 was \$4,335,358. The value of the forest products increased from \$1,724,378 in 1899 to \$2,949,732 in 1909.

The leading horticultural crops are fruits and nuts, the products of which were valued at \$49,917,655 in 1909; vegetables (including potatoes), the total acreage of which, in 1909, was 151,962, and their value \$12,121,958; flowers, plants and nursery products, the acreage of which was 5,816 in 1909, an increase of 62.2 per cent since 1899, and their value \$3,601,301; and small-fruits comprising an acreage of 9,687 in 1909, an increase of 54.2 per cent since 1899. The value of the small-fruits in 1909 was \$1,789,214.

The total quantity of orchard-fruits produced in California in 1909 was 31,501,507 bushels, valued at \$18,358,897. Plums and prunes, peaches and nectarines, apples and apricots are the most important of the orchard-fruits. In 1909, there were produced 9,317,979 bushels of plums and prunes, valued at \$5,473,539; 9,267,118 bushels of peaches and nectarines, valued at \$1,573,775; 6,335,073 bushels of apples, valued at \$2,901,662; and 4,066,823 bushels of apricots, valued at \$2,768,921. Of the orchard-fruits of less importance, there were produced in 1909, 1,928,097 bushels of pears, valued at \$1,660,963; 501,013 bushels of cherries, valued at \$951,624; and 32,638 bushels of quinces, valued at \$26,266, together with 52,766 bushels of mulberries, valued at \$2,147.

The production of grapes in 1909 amounted to 1,979,686,525 pounds, valued at \$10,846,812. The number of vines of bearing age in 1910 was 144,097,670; those not of bearing age, 39,526,319.

The production of nuts in 1909 was 28,378,115 pounds, valued at \$2,959,845. Most of the nuts were Persian or English walnuts and almonds, there being produced in 1909, 21,432,266 pounds of the former, valued at \$2,247,193 and 6,692,513 pounds of the latter, valued at \$700,304. The production of other nuts and their value are as follows: 159,374 pounds of black walnuts, valued at \$2,562; 44,955 pounds of pecans, valued at \$4,632; 37,153 pounds of chestnuts, valued at \$3,474; and 4,550 pounds of Franquette, valued at \$910.

The value of the tropical fruits in 1909 was \$16,752,101, an increase from \$7,219,000 in 1899. The value of oranges represents three-fourths of this total, and the value of lemons is next in importance. In 1909, the production of oranges was 14,436,180 boxes, valued at \$12,951,505; that of lemons 2,756,221 boxes, valued at \$2,976,571; that of olives, 16,132,412 pounds, valued at \$401,277; that of figs, 22,990,353 pounds, valued at \$260,153; and that of pomelos (grapefruit), 122,515 boxes, valued at \$143,180. Other tropical fruits grown in California are loquats, tangerines, guavas, Japanese persimmons, pomegranates, mandarins and dates.

Strawberries are by far the most important of the small-fruits raised in California, with raspberries and loganberries, and blackberries and dewberries ranking second and third, respectively. The total production in 1909 was 26,824,120 quarts, as compared with 14,852,000 quarts in 1899. The acreage of strawberries increased from 2,418 in 1899 to 4,585 in 1909; the production in 1909 was 15,691,326 quarts, valued at \$1,149,475. The acreage of raspberries and loganberries increased from 987 in 1899 to 1,992 in 1909; the production in 1909 was 5,222,117 quarts, valued at \$304,169. The acreage of blackberries and dewberries increased from 1,960 in 1899 to 2,576 in 1909; the production in 1909 was 4,898,524 quarts, valued at \$282,383. The production of the other small-fruits, and their value, in 1909, was as follows: currants, 852,378 quarts, valued at \$43,508; gooseberries, 145,119 quarts, valued at \$9,086, and cranberries, 10,656 quarts, valued at \$443.

Of the vegetables grown in California, potatoes, sweet potatoes and yams are the most important. The acreage of potatoes in 1909 was 67,688, an increase of 60.8 per cent from that in 1899, when it was 42,098. The production of potatoes, in 1909, was 9,824,005, valued at \$1,879,449. During the same period, the acreage of sweet potatoes and yams increased 218 per cent; an increase from 1,607 acres in 1899 to 5,111 acres, in 1909. The production in 1909 was 572,814 bushels, valued at \$355,624. The leading vegetables, other than potatoes, sweet potatoes and yams, their acreage, and value in 1909 follow: asparagus, 9,399 acres, valued at \$448,694; green beans, 7,646 acres, valued at \$309,439; cabbage, 3,617 acres, valued at \$306,858; cantaloupes, 5,784 acres, valued at \$106,944; celery, 2,881 acres, valued at \$381,759; onions, 4,391 acres, valued at \$472,808; tomatoes, 5,932 acres, valued at \$504,704; and watermelons, 6,065 acres, valued at \$255,977. Among the other vegetables grown were beets, carrots, cauliflower, sweet corn, cucumbers, lettuce, green peas, green peppers, rhubarb, turnips, and squash.

The total acreage of flowers and plants in 1909 was 1,013, as compared with 672 in 1899. The number of square feet under glass in 1909 was 5,037,132, of which 4,422,423 were covered by greenhouses and 614,709 by sashes and frames. The value of the products from flowers and plants in 1909 was \$1,388,513.

The acreage of nursery products increased 64.8 per cent from 1899 to 1909, the number of acres being 4,803 in 1909, as compared with 2,914 in 1899. The value of the nursery products in 1909 was \$2,212,788, as compared with \$558,329 in 1899.

CHARLES H. SHINN.

ALASKA.

When considered from a horticultural or agricultural point of view, Alaska (Fig. 2535) may be very conveniently divided into two divisions, the southern coast region and the interior. These two regions differ very materially in their climate, and may be ultimately found as unlike in their possibilities. The climate of the coast region, which extends from Dixon's Entrance on the southeast to Unalaska on the southwest, is characterized by a heavy rainfall, a great preponderance of cloudy weather, and a rather low summer temperature, with little or no diurnal variation in the readings of the thermometer. The winter temperature is not excessively cold, zero weather being seldom experienced, while in the summer it is seldom high. The average rainfall, as shown by data from the Government Weather Service, varies between 55.9 inches at Killisnoo to 112 inches at Sitka, 113.6 inches at Unalaska, and 144.5 inches at Fortman Fish Hatchery, about one-third of the precipitation falling during the growing period, from May to September. The data concerning the interior portion of the country are mainly from along the Yukon River, that being the great thoroughfare of the region, and also from the valleys of the Tanana and Copper rivers. Here the rainfall is slight, varying between 9.31 inches at Copper Center, 10.8 inches at Rampart, and 13.6 inches at Fairbanks, and during summer clear skies are the rule. The intense cold of winter is followed by comparatively warm temperature in the summer, with a growing period of about four months, although occasional frosts have been reported from the upper part of the valley during the summer months. Maximum temperatures of above 90° F. have been reported from a number of interior stations. The regions about Cook Inlet and the lower part of the valley of the Susitna River have an intermediate climate, more rainfall than the interior valleys, and colder winters than those of the coast region.

The soils of the two regions, which in many places are thin and from various causes quite acid in reaction, are very similar, being largely of vegetable origin over-

lying rock or glacial deposits. In the coast region, arable areas are confined to rather narrow valleys and the slopes along the sea. In the interior are reported more extensive areas of comparatively level land. Of the coast region, the most extensive area of land adapted to cultivation is that on the Kenai Peninsula, and, extending across Cook Inlet, is continued up the Susitna River. This region, on account of its position relative to ocean currents, partakes more of the climatic characteristics of the interior, although still somewhat modified.

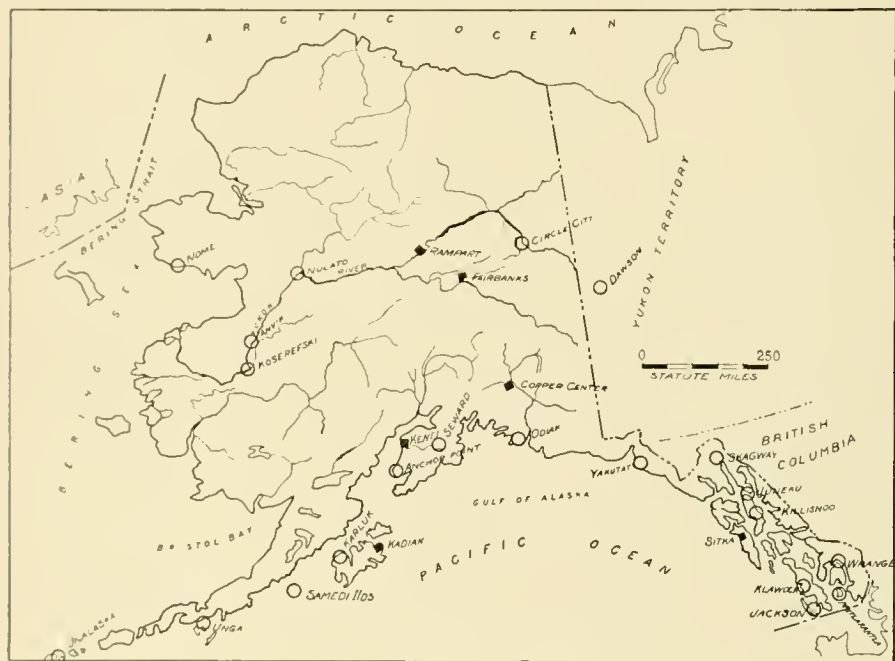
The accompanying map shows regions where some attempts have been made in gardening, from which definite reports have been secured. From the data at hand it seems probable that the local supplies of hardy vegetables might be produced nearer at hand than the Puget Sound. This is undoubtedly true of many parts of the country, where the production need be limited

experiments conducted at experiment stations which have been maintained by the United States Department of Agriculture for ten or more years at Sitka, Fairbanks, Rampart, Copper Center, Kenai, and Kodiak. At all these places trials have been conducted of all the more important vegetables, and at Sitka of a considerable number of fruits and berries, as well as various ornamentals.

The great abundance, both in kind and quantity, of native fruits, especially berries, has doubtless contributed to the delay in the attempted introduction and cultivation of other sorts. Some early effort was made in this line, as is shown by the presence at Sitka of a number of old apple trees, remnants of the Russian days, which bear a very inferior fruit. A few young bearing trees of unknown variety are grown at the same place. At Wrangell, there were in 1898 apple trees of what were thought to be the Red June variety in bearing,

and young thriving trees are known at Juneau and Metlakatla. The mountain-ash (*Sorbus sambucifolia*) is grown as an ornamental tree. Attempts have been made at a number of places to cultivate some of the indigenous fruits, and the dewberry or "kneshe-neka" (*Rubus stellatus*), wild currants (*Ribes rubrum* and *R. bracteosum*), and the strawberry (*Fragaria chiloensis*) have all been domesticated, and their fruit is fully equal, if not superior, to the wild product.

At the Sitka Station, a number of apple trees, representing thirty or more varieties of crab, Russian, and other early apples, plum trees, and cherry trees have been under observation in the nurseries



2535. Alaska.

only by the demand for such supplies and the ability to secure arable lands at a cost that will permit the producer to compete with the Sound country. For some time certain economic features will enter into the subject of extensive horticulture. Among these are the high price of labor, the standard being at present determined by the wages paid for gold-mining, the question of transportation, and the rather limited markets.

As it exists at the present time, horticulture in Alaska is of a very primitive type. A few gardens here and there, with perhaps a row of berries along the side and an occasional fruit-tree, represent nearly all that is done along this line. Near all the more important towns are market-gardens of considerable importance, but elsewhere only small areas are cultivated.

It has been said that during the Russian occupancy of the country, many attempts were made to cultivate gardens and fields, but the data are often so meager and contradictory as to throw doubt upon the sincerity of the endeavor. In the accompanying account, it is desired to place on record some of the horticultural achievements as gathered from reports from gardeners in many places, the personal observations of the writer during two seasons in the country, and the results of

for several years. In 1911, five varieties bore mature fruit. These varieties were Yellow Transparent, Raspberry, Sylvan Sweet, Whitney, and Hyslop. In 1915 the first three varieties and Tetofsky ripened fruit. Among several varieties of cherries tested, Early Richmond has done the best and it has borne a light crop for several years. Of the plums planted, all have bloomed profusely, but none has as yet borne any fruit. The small bush-fruits thrive well over southeastern Alaska and the currant and raspberry have been successfully grown in the interior. Currants, both red and black, are indigenous to Alaska, and many of the improved varieties have been successfully introduced, and distributed by the stations. Gooseberries also do well along the coast region, and they do not seem as subject to mildew as when grown elsewhere. White-smith, Columbus, Industry, Triumph, and Champion are varieties of gooseberry that have been successfully grown at the Sitka Station. Among the cultivated raspberries, Cuthbert does the best of any thus far tested. The fruit produced is large and well flavored, and the bushes are quite hardy. It has a long fruiting period, being in bearing at Sitka from August to October. Experiments with blackberries, dewberries, logan-

berries, and grapes have thus far resulted in failure. The wild salmon berry is widely distributed throughout Alaska, especially in the southeastern part. Crosses have been made between this and the cultivated raspberry, but the fruits thus far produced have been of very ordinary character. Strawberries are grown to some extent and at the Sitka Station hybrids have been made between a cultivated fruit of unknown origin and the native coast species of *Fragaria*, with the result that about thirty varieties exceeding the parent plants in all desirable qualities have been produced and are being propagated. The plants have proved absolutely hardy and the fruit is of large size and good quality.

More attempts have been made to grow vegetables than fruits, and some definite data have been obtained, showing what varieties are known to be adapted to Alaskan conditions. Most of the earlier data have been secured from Sitka and Wrangell, in the southeastern part of the country, and from the Holy Cross Mission, near Koserefski, on the lower Yukon. A report from the latter place states that potatoes of fine quality, weighing one and one-fourth pounds, and turnips weighing five and one-half pounds, were grown during the summer of 1898. In addition, notes were given of some of the varieties of vegetables adapted to the region, as follows: cabbage—Early Jersey Wakefield, Flat Dutch, and Drumhead; cauliflower—Early Snowball, Early Dwarf Erfurt; turnips—Early Flat Dutch, Yellow Globe, and Extra Early Milan; rutabagas—Improved American; radish—French Breakfast and Chartier; onions—Extra Early Red and Yellow Danvers; lettuce—Golden Heart; peas—American Wonder and Early Alaska; beets—Eclipse and Edmand's Blood Turnip; carrot—Oxheart; parsley—Extra Early Double Curled; celery—White Plume, Giant Pascal; rhubarb—Victoria.

The same varieties, with numerous additions, have succeeded in the coast region as well as at interior points. Snap beans, Challenge Black Wax, and Golden Wax have done fairly well at Sitka, where experiments were begun by the United States Department of Agriculture in 1898, and the English Windsor is quite in its element. At this place the Philadelphia Butter and San Francisco Market lettuce made fine heads of a most superior quality. Parsnips and carrots grow well, and salsify and spinach were successfully grown at Sitka, in 1898, for perhaps the first time. Peas were found to grow and yield well, and, in addition to the varieties above given, some of the dwarfs and the Norwegian sugar peas continued to produce their crop until cut off by the frost. The blood beets, Extra Blood Turnip and Extra Early Egyptian, grew well at Sitka, but in many places beets are a failure on account of their tendency to run to seed. This undesirable trait on the part of biennial plants is shared by other vegetables, principally turnips, although cabbage and cauliflower have been reported as doing likewise. It is believed by some growers that the flat type of turnip is more subject to run to seed than the globe type. Celery of exceedingly fine quality is grown at a number of places, although at Kodiak specimens have been seen in which the central axis was greatly elongated. The leafstalks were also lengthened in about the same proportion, and this trait was not considered undesirable.

Potatoes are more extensively grown in Alaska than any other crop, and the quality varies with the variety, locality, season, and culture. Usually little choice is exercised in the matter of varieties, but Eureka, Freeman, Early Ohio, Gold Coin, and Irish Cobbler appear well adapted to the conditions existing in this region. The two last are the best yielding varieties, and very favorable reports have been received from them wherever tried. Season and method of planting undoubtedly exert a strong influence on the crop. If the soil, which

usually contains a high proportion of organic matter and moisture, is well drained or thrown up into beds, as is the custom in many places, good potatoes can be grown in the average season. Field trials of potatoes at the Rampart Station in 1911 gave yields at the rate of over 300 bushels an acre for Irish Cobbler, Gold Coin, and Eureka. Sprouting the tubers in flats in the light for two or three weeks before planting has been found advantageous in securing better quality and maturity of potatoes. In some parts of the country, especially from Cook Inlet westward, the natives until recently cultivated a small round potato, called the Russian, that seemed to be well suited to the country. It is said to have been brought from Siberia fifty or more years ago. Close planting of potatoes, as well as almost every other vegetable, is too often the rule, and to this fact alone may be attributed many failures. The object seems to be to grow a large crop by planting an abundance of seed. The result is a large growth of tops that completely shade the ground, thinning being seldom or never practised. Along the coast, where cloudy weather is the rule, it is safe to say that the sun's rays never strike the ground after the growing season has become well advanced. Under such conditions it is not an uncommon sight to see a crop of small potatoes borne in the axils of the leaves above ground, no tubers being formed below the surface.

Enough is now known of Alaska to warrant the claim that radish, mustard, turnips, kale, and lettuce can be grown anywhere up to the Arctic Circle, and, in favorable localities, even farther north than that. Carrots, parsnips, parsley, peas, cress, cabbage, cauliflower, brussels sprouts, onions, spinach, beets, rhubarb, potatoes, and mint, sage, thyme, and caraway among the herbs, can be grown along the coast and in the interior almost to the Arctic Circle if gardens are selected with reference to soil and exposure to the sun. Asparagus, beans, celery, cucumbers, squash, and salsify can be grown if planted in warm spots and given proper care and attention. In favored localities, especially about Hot Springs near Fairbanks, sweet corn, melons, tomatoes, eggplants, and other tender plants are successfully grown and on account of their rarity command high prices.

In general, considerable judgment is shown in the choice of garden sites. A southwestern slope is always preferred, and, if well drained, the garden is usually a thrifty one. In many places, the earth is thrown up into beds 4 or 5 feet wide and the crop planted crosswise the beds. Where it can be easily obtained, sand is added to warm and to lighten the soil. Kelp is extensively employed as a fertilizer in some places near the coast, but its value when added to a soil already largely composed of vegetable debris is questionable. Market-gardens have been successfully maintained for years at Skagway, Dawson, Circle City, Fairbanks, and other of the great mining centers of the Yukon, and the dirt roof of the miner's cabin is frequently utilized for early gardens, the heat from within supplying the necessary warmth required for growing early radishes, onions, lettuce, turnips, and the like.

The abundance of native fruits, especially of berries, has already been mentioned, and an enumeration of some of them would seem not out of place. Of widest distribution are the salmon berries (*Rubus spectabilis*), two so-called cranberries (*Viburnum pauciflorum* and *Vaccinium Vitis-Idæa*), currants (*Ribes rubrum*, *R. bracteosum*, and *R. laxiflorum*), crowberries (*Empetrum nigrum*), huckleberries (*Vaccinium uliginosum* and its var. *mucronatum*), blueberries (*V. ovalifolium*), red huckleberries (*V. parviflorum*), the molka or baked-apple berry (*Rubus Chamæmoros*) improperly called salmon berry in the interior, and raspberries (*Rubus strigosus*). Of less general distribution, yet very abundant in places, may be mentioned strawberries (*Fragaria chiloensis*), dewberries (*Rubus stellatus*), thimble

berries (*R. parviflorus*), salal (*Gaultheria Shallon*), bog cranberries (*Vaccinium Oxycoccus*), bearberries (*Arctostaphylos alpina*), and so on.

Horticulture is not wholly neglected in Alaska, although but few data are available. Many of the hardier plants of the old-fashioned flower-garden are to be seen. Pansies of great size and brilliant color are common, and they remain in flower all summer. In some parts of the country sweet peas do well, and poppies, nasturtiums, mignonette, sweet alyssum, chrysanthemums, stock, candytuft, verbenas, and marigolds are not uncommon where any attempt is made to grow flowers. Window gardens and boxes add many sorts to the list already given.

Among ornamental perennials that have succeeded well with slight protection, or at Sitka with none, are phlox, milfoil, poppies, buttercups, columbines, iris, spirea, *Rosa rugosa*, Tartarian honeysuckle, and the like.

Experiments conducted under the direction of the Office of Experiment Stations, United States Department of Agriculture, at its stations and in cooperation with gardeners throughout the Territory for more than twelve years, have shown that much can be accomplished in various lines of horticulture if rational methods of culture and a proper selection of varieties and seed are followed. The possibility of locally producing seed of peas, turnips, rutabagas, mustard, and potato seed tubers has been fully demonstrated, and wherever such seed is planted better crops are almost invariably secured.

But little trouble has been met with from fungous diseases and insect pests, except for some mildews of apple, gooseberry, and currant, and from a root maggot that attacks many cruciferous plants. Spraying for the mildews, and rotation, and varietal selection have proved valuable aids in combating the root maggot. A variety of turnips, Petrowski, has proved quite resistant to their attack wherever it has been tried.

For further information, consult Yearbook of Department of Agriculture for 1897; Office Experiment Stations, United States Department of Agriculture, Bulletins Nos. 48 and 56; Alaska Experiment Stations, Bulletin No. 3, and Reports 1898 to 1914.

WALTER H. EVANS.

NOTHOCHLÆNA: *Notholæna*.

NOTHOFAGUS (Greek words, meaning *not a true beech*). *Fagaceæ*. A genus of about 12 species, native of S. Amer., Austral. and New Zeal., closely allied to *Fagus*, but chiefly distinguished by the fls., both staminate and pistillate ones being borne in 3's or solitary. The lvs. are generally small, often evergreen and either plicate in bud, like those of *Fagus*, or not. The wood of some species, especially that of *N. Dombeyi* and *N. procera*, in Chile, and of *N. Cunninghamii*, in Austral., is much valued. They are not hardy in the N., and but little known in cult. The two following species have been recently intro. by the Dept. of Agric. *N. obliqua*, Blume (*Fagus obliqua*, Mirb.). Deciduous tree, attaining 100 ft.; young branchlets glabrous; lvs. ovate-oblong, acutish or obtuse, oblique at the base, serrate, lobulate below the middle, glabrous or nearly so, with 8-11 pairs of veins, 1-2½ in. long; involucre 4-valved; nuts 3, 2 triangular and 3-winged, 1 flattened and 2-winged. Chile. *N. procera*, Oerst. (*Fagus procera*, Poepp. & Endl.). Similar to the preceding; lvs. oblong, rounded at both ends, doubly crenate-serrate, pubescent beneath, up to 4 in. long. Chile.—The following 6 species have been intro. into European gardens and have proved fairly hardy in S. England and Ireland. *N. antarctica*, Oerst. (B.M. 8314, var. *uliginosa*, J.H.S. 37:53), *N. betuloides*, Oerst. (G.C. 1872: 467; H. 25:105; H. 33:11), *N. Cunninghamii*, Oerst. (B.M. 8581), *N. cliffortioides*, Oerst., *N. fusca*, Oerst., and *N. Moorei*, Krasser. They are

all trees or sometimes shrubby, with small, ovate or elliptic crenate-dentate lvs., ½-1 in. long. The first one is deciduous, the others evergreen. They are perhaps oftener enumerated under *Fagus*, but besides the difference in the fls. they are different in habit, especially on account of their very small lvs., large only in *N. procera*. Prop. is by seeds or by layers.

ALFRED REHDER.

NOTHOLÆNA (Latin, *spurious, cloak*; from the rudimentary indusium). *Polypodiaceæ*. Often written *Nothochlæna*, but the above is Robert Brown's original orthography. A group of mostly warm temperate rock-loving ferns, differing from *Cheilanthes* mainly in having no marginal indusium. Some of the species are coated with a golden or silvery wax-like powder. The following have been advertised only once by a dealer in native plants. Culture as in *Cheilanthes*, pages 734 and 1217.

a. Foliage densely scaly beneath.

b. Lvs. once-pinnate.

sinuata, Kaulf. Lf.-blades 1-2 ft. long, 1-3 in. wide, growing on short stalks from thick, scaly rootstocks; pinnae thick, entire or deeply pinnatifid; lower surface with rusty scales. S. W. U. S. to Chile.

ferruginea, Hook. Lf.-blades 6-12 in. long, ½-1 in. wide, growing on wiry black stalks from thick, dark, scaly rootstalks; pinnae deeply pinnatifid, with blunt lobes; texture thinner; lower surface densely matted with wool. S. W. U. S. to W. Indies and Chile.

BB. Lvs. 3- to 4-pinnate.

Néwberryi, D. C. Eaton. COTTON FERN. Lf.-blades 3-5 in. long, on stalks of the same length; ultimate segms. ⅓-½ line wide, covered on both sides with slender, entangled hairs, which are more dense on the under surface. Calif.

Párryi, D. C. Eaton. LACE FERN. Lf.-blades 2-4 in. long, tripinnate, with crowded roundish obovate segms. 1 line wide, which are densely covered above with entangled white hairs, beneath with a heavier pale brown wool. Utah to Calif.

AA. Foliage with white or yellow powder beneath.

cretæa, Liebm. Rootstock short, with rigid scales; lf.-blades 1-2 in. each way, pentagonal on brownish stalks 2-7 in. long; ultimate segms. oblong or triangular-oblong, crowded. S. Calif. and Ariz.—Less handsome than the similar but larger and less divided *N. Hookeri* of Texas to Ariz.

cándida, Hook. Rootstock creeping; lf.-blades 3-6 in. long, ovate or deltoid-ovate, pinnate; lowest pinnae with inferior pinnules elongated and again pinnatifid; upper surface green. Texas and New Mex.

AAA. Foliage naked below.

ténera, Gillies (*Pellaea ténera*, Prantl). Lf.-blades 3-4 in. long, ovate-pyramidal, 2-3-pinnate; pinnae distant, with ovate or subcordate, smooth, naked segms. S. Utah and Calif. to Bolivia.—Very rare.

L. M. UNDERWOOD. R. C. BENEDICT.†

NOTHÓLCUS (Greek, *nothos*, false, and *Holcus*, the name formerly applied to this group). *Gramineæ*. Perennials with woolly or downy flat blades and narrow panicles: spikelets 2-fl'd., the lower floret perfect and awnless, the upper staminate and awned.—Species about 8, Eu. and N. Afr.

lanátus, Nash (*Holcus lanátus*, Linn.). VELVET-GRASS. Two to 3 ft. high; blades velvety; panicle greenish or purple-tinged. Dept. Agric., Div. Agrost., 20:89. Eu.—A forage grass of poor quality but of some value on sterile soil. A variegated form is cult. abroad for ornament.

A. S. HITCHCOCK.

NOTHOPANAX: Discussed under *Polyscias*.

NOTHOSCÓRDUM (Greek, *false garlic*). *Liliaceae*. Herbs having an onion-like bulb and closely related to *Allium*.

Bulb tunicated, without the onion odor and taste: scape 6–12 in. high: lvs. several, linear, basal, 6–12 in. long: fls. yellow or white, in an umbel; style obscurely jointed; ovary 3-loculed; ovules several in each locule: caps. oblong-ovate, somewhat lobed, obtuse.—About 10–20 species mostly found in Trop. S. Amer., 1 in China and at least 1 in N. Amer. The species in this genus are variously placed under *Allium* and *Ornithogalum* by some authors.

biválve, Brit. (*N. striatum*, Kunth. *Ornithogalum biválve*, Linn.). **YELLOW FALSE GARLIC**. **STREAK-LEAVED GARLIC**. Bulb globular, 1 in. through, sometimes bearing bulblets at base: scape 1 ft. or less high: lvs. 7–8 in. high, $\frac{1}{2}$ – $\frac{1}{3}$ in. broad, flat, blunt, shorter than scape or equalling it: fls. yellowish, 6–12 in an umbel on slender pedicels, the segms. narrowly oblong, 4–6 lines long; ovules 4–7 in each cell. Early spring. Va. to Ohio, Tenn., Neb., Fla., Texas, and Mex.—Hardy. Procurable from dealers in native plants.

frágrans, Kunth (*Allium frágrans*, Vent.). Bulb larger, round, yellowish white: lvs. linear, obtuse, 8–12 in. long: scape rotund, attaining height of 20 in.: spathe 2-parted, shorter than pedicels: fls. fragrant, 8–20 in an umbel, white slightly blushed, lined dark; stamens and anthers purplish. Subtrop. Amer.—Not very hardy; better treated as a tender bulb and dug up in fall, planting in spring. A. C. HOTTES.†

NOTÒNIA (named for an English botanist, Noton). *Compósité*. About a dozen fleshy herbs or undershrubs, of Trop. Afr. and Asia, by many botanists included in *Senecio*. Heads discoid (without rays); style-branches with ovate or lanceolate papillose extremities; otherwise as *Senecio*: lvs. rudimentary or succulent, and the yellow or red heads rather large, solitary or eymose. They are to be treated like *kleinias* and various succulent tropical *senecios*; grown mostly as oddities and little known to gardeners.

N. amaniensis, Engler. Lvs. spatulate, fleshy, about 6 in. long and $\frac{1}{2}$ in. wide: scape rising to 4 ft., with 3 or more heads of yellow fls. on long reddish peduncles. E. Trop. Afr. *N. Grántii*, Oliver & Hiern. (*Senecio longipes*, Baker. *Kleinia Grántii*, Hook. f. *N. semipervirens*, Asch.). Short fleshy glaucescent plant: st. 4–8 in. high from a tuberous root, decumbent, bearing the peduncle at the summit: peduncle scape-like, with a few linear scale-like lvs. and bearing about 2 or 3 stalked orange-scarlet heads. B.M. 7691. G.C. III. 45:227. If this plant is the same as the *Cacalia semipervirens*, Forsk., it must then bear the name *N. semipervirens*, Asch. L. H. B.

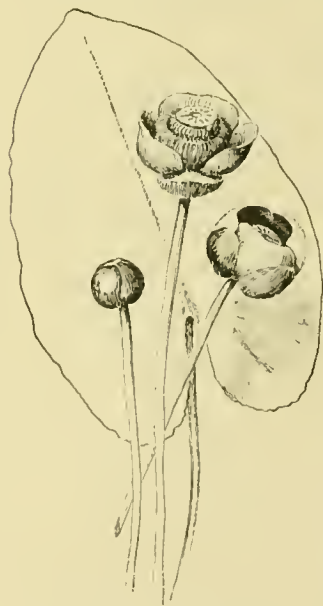
NOTOSPÁRTIUM (name from *Spartium* or broom). *Leguminosæ*. Two shrubs, leafless at maturity, with compressed pendulous branches, of New Zeal., one of them more or less planted in Great Britain. Fls. papilionaceous, rather small, in lateral racemes; calyx 5-toothed, campanulate; standard obovate or obcordate, clawed and somewhat reflexed; keel hatchet-shaped and obtuse; wings shorter than the keel, oblong, auricular at base; stamens 9 and 1; pod linear and many-jointed (and in this differing from *Carmichaelia*). *N. Carmichaeliæ*, Hook. f. **PINK BROOM**. Much-branched, to 10 ft. high, the branches glabrous and bearing alternate scales, the lvs. (only on young plants) 1-foliate and orbicular or obcordate: racemes 1–2 in. long, bearing pink fls.: pod about 1 in. long. S. Isl. of New Zeal. B.M. 6741. G.C. III. 42:146. Gn. 71, p. 428; 74, p. 143.—A rare and local plant in New Zeal., blooming there in summer (Dec.–Jan.). Hardy in the open at the Kew Gardens, England.

NOTÝLIA (*back and hump*, alluding to a lump or protuberance on the column). *Orchidaceæ*. About 20 Trop. American orchids of the *Vanda* group, little grown. They need warmhouse treatment. Small low plants, with plane coriaceous or fleshy lvs.: fls. inconspicuous, white, greenish or yellow, on radical racemes; sepals equal, narrow, erect or becoming spreading, free or the 2 lateral ones connate; petals resembling the sepals; lip unguiculate, entire, sometimes slightly adnate to the column; pollinia 2, waxy, not appendaged. *N. bicolor*, Lindl. “Whole plant not more than an inch and a half high: lvs. generally about 5, equitant, stiff, acuminate, scimitar-shaped, scarcely half the length of the fl.-spikes.” Sepals white, and petals lilac with blue spots at base, lip lilac: spikes drooping. Guatemala. B.M. 5609. *N. trisépala*, Lindl. & Paxt. Epiphytic: pseudobulb $\frac{1}{2}$ in. long, 1-lvd.: lvs. oblong, to 3 in.: scape pendulous, about $\frac{1}{2}$ ft. long, with a many-fl. raceme of pale green very small fls. with scoop-shaped lip. Mex. B.M. 8306. *N. sagittifera*, Hook. (*Pleurothallis sagittifera*, HBK. *N. multiflora*, Lindl.). Stemless parasite: lvs. distichous, deciduous, oval-lanceolate, nerveless: spikes axillary, many-fl., cernuous, the fls. bright rose-color. Guiana. L. H. B.

NÛPHAR (from the Arabic). *Nymphæa* of some authors. *Nymphæaceæ*. **SPATTER-DOCK**. **YELLOW POND-LILY**. Several aquatic plants of the North Temperate Zone, with stout rootstocks creeping in the mud.

Leaves large, cordate-ovate or sagittate, some of which may be submerged and others either floating or

standing erect above the water: fls. usually standing above the water, yellow or purplish, single on the scapes, the 5 or more large concave sepals constituting the showy part of the fl.; petals mostly numerous, small and simulating stamens, the latter numerous and short; ovary short, globular-ovoid, with 8–24 stigmas forming rays on its top; fr. an emersed caps.—Most of the nuphars are N. American. They grow in stagnant pools or on the margins of slow-running mud-bottom streams. Several species have been offered by dealers, but most of them have small value for the cultivator, although the foliage effects of *N. advena* may be



2536. *Nuphar advena*. ($\times \frac{1}{2}$)

striking. For cult., see *Nymphaea* and *Aquatics*.—The N. American species are monographed by Miller & Standley in *Contrib. U. S. Nat. Herb.* XVI, part 3 (1912). The nomenclature is discussed under *Nymphaea*.

A. Lvs. mostly cordate-ovate.

B. Plants strong and large.

advena, Smith. **COMMON SPATTER-DOCK**. **COW LILY**. Fig. 2536. Lvs. large (about 1 ft. long), varying from roundish to ovate or almost oblong, thick, with a deep and mostly open basal sinus, the lower surface often pubescent; petioles terete; submerged lvs. usually wanting: fls. 2–3 in. across, more or less globular (not wide opening), yellow, mostly tinged with green

or brown; petals shorter than the stamens, fleshy and truncate; sepals 6; stigma nearly entire, yellow or pale red, 12-21-rayed. N. Y., southward and westward. Mn. 1:17. G.C. II. 20:557. V. 2:197. Var. *variegatum*, Engelm., with floating lvs. only (none erect), closed sinus, petioles flat on one side and fls. partly purple, occurs from New Bruns. to Brit. Col., Iowa, N. Ohio, and the mountains of Pa.

rubrodiscum, Morong. Lvs. somewhat smaller; submerged lvs. usually present; fls. 1-1½ in. across, yellow; sepals 5-6; stigma crenately toothed, bright red or crimson, 9-13-rayed. New Bruns. to Mich. and Pa.

polysépalum, Engelm. Larger than *N. advena*, the lvs. three-fourths as broad as long, erect in shallow water and floating in deep water; fls. 4-5 in. across, yellow, the sepals 9-12, and the petals 12-18, cuneate. Colo., Wyo. and northward.

luteum, Sibth. & Smith. EUROPEAN YELLOW POND-LILY. Lvs. cordate-ovate, floating or rising little above the water; petiole triangular; fls. yellow, somewhat fragrant, smaller than those of *N. advena*, the sepals 5, petals very numerous; stigmas 10-30-rayed, with entire margin. Eu.

BB. *Plant slender, often delicate.*

minimum, Reichb. (*N. pumilum*, Smith). Slender; lvs. small, oblong, with a deep sinus and spreading lobes; petiole slender, 2-edged; fls. 1 in. or less across, yellow; sepals 5; petals 9-12; stigma 8-12-rayed, yellow, margin prominently indented. Eu.—Easily cult. and free-flowering.

microphýllum, Pers. (*N. Kalmianum*, R. Br.). Very slender, with prominent submerged lettuce-like lvs., the emerged ones floating and only 3 or 4 in. long; fl. 1 in. or less across, yellow, with 5 sepals and thin spatulate petals; stigma 7-10-rayed, dark red. New Bruns. to Pa. and Minn. and southward.

AA. *Lvs. long-sagittate or narrow-oblong.*

sagittæfolium, Pursh. Rather stout; emerged lvs. floating, about 1 ft. long and 2-3 in. wide, sinus open; submerged lvs. similar in shape, crispate, numerous; fls. 1 in. across, yellow, the sepals 5, the petals spatulate; stigma 11-15-rayed; fr. almost cylindric. N. and S. C.

japónicum, DC. Similar to the last. Submerged lvs. large, crisped; fl. 2-3 in. across; fr. flask-shaped. Japan.—A form with red-tipped stamens and sepals is cult.

HENRY S. CONARD.

NURSERY: in horticulture, an establishment for the rearing of plants. Properly, a nursery exists for the rearing of any kind of plant, but in America the word is restricted to an establishment devoted to the growing of hardy, more particularly woody plants. This is because of the early and great development of orcharding and tree-planting and the relative infrequency at that time of glass structures and private estates employing gardeners.

In North America the nursery business, as we now know it, is practically an institution of the last century, although there were nurseries more than a century ago. Consult pages 1516-1518 for an historical sketch of the nursery business; also in Vol. III the biographies of nurserymen, as Barry, Berckmans, Brackett, Bush, Cole, Conard, Dartt, Douglas, Downer, Ellwanger, Garey, Hoikes, Hogg, Hoopes, Hovey, Kenrick, Kerr, Lewelling, Manning, Meehan, Moon, Munson, Parsons, Prince, Ragan, Reasoner, Rock, Roeding, Saul, Saunders, Shinn, Smith, Stark, Teas, Thomas, Wharton, Woolverton, and others.

As early as 1768, according to J. H. Hale, the New York Society for Promotion of Arts awarded Thomas Young a premium of £10 for the largest number of apple trees, the number being 27,123. But the large trading nursery developed simultaneously with the

great orchard-planting industry which began in western New York and extended westward, and, since the Civil War, to the southward. The largest nursery center of North America, considering the number of persons engaged and the variety of stock grown, is western New York, with headquarters in Rochester. Nearly one-ninth of all the nurseries enumerated in 1890 were in New York state, and these establishments employed a capital of over \$12,000,000. In 1909, New York still led in the value of nursery products. Very extensive nursery enterprises are now established in many other parts of the country, and it is probable that the center of the nursery business will move westward.

In America, nursery stock is grown on a broad or extensive rather than intensive scale. This is particularly true of fruit-trees. These trees are to be set in wide and open orchards, and the nursery practices are therefore very unlike those that obtain in Europe. In the latter country, for example, fruit-trees are trained in the nursery row to assume definite shapes. Some are trained for standards,—to grow to one straight, bare trunk. Others are trained for bush specimens, some for growing on walls and espaliers, some with round heads, some with conical heads, and the like. It is the pride of the American nurseryman, however, that his rows shall be perfectly even and uniform. Any break in this uniformity is considered to be a blemish. If every tree could be a duplicate of every other, his ideal would be attained. Ordinarily, fruit trees are trained to single stems, the top starting at 2 or 3 feet from the ground.

All fruit trees are budded or grafted. In early days, piece root-grafting the apple was a common practice in the eastern states; but it has gradually given way to budding and thereby a top is supplied with one whole strong root. In some places, however, root-grafting is still popular, partly because more than one tree may be made from an individual root, and partly because it allows the operator to use a long cion and to put the foster root far below the surface, thereby allowing the cion to send out its own roots and causing the tree to become own-rooted and to have a known hardness.

In the use of whole roots, rather than pieces, there is apparently little or no difference in the orchard between the budded and grafted trees; but when grafting is performed on pieces of root, the results are likely to be unsatisfactory. Some varieties of apple, among which may be mentioned Grimes Golden, are not long-lived, being subject to collar-rot or other disabilities. To correct this fault, nurserymen double-work these weak varieties on the bodies of hardy long-lived, resistant trees such as Northern Spy and others.

There are many diseases and pests in the growing of all kinds of nursery stock, and these are now treated in official publications of government and experiment stations. The extent of these dangers has resulted in special laws and regulations to control the spread of pests and diseases. See *Inspection*, page 1647.

The most widespread and fundamental difficulty, however, is the inability to grow many crops of trees on the same land with good results. In fact, in the case of fruit-trees, it is usually considered that land which has been "treed" is therefore unfit for the growing of other fruit stock until it shall have rested in clover or other crops for a period of five years or more. Ornamental stock is often grown continuously on the same land with good results, even when the same species is grown. This is largely due to the fact that ornamental stock is sold by its size and not by its age, and therefore rapidity of growth is not so important as it is in the case of fruit-trees. It has been supposed that this necessity of rotation is due to the exhaustion of certain plant-food elements from the soil. It has been found by experiments, however, that such is not the case. The chief difficulty seems to be physical. Lands that are devoted to nursery stock for one crop, which is from

two to five years, becomes void of humus, and the digging of the stock when the land is wet or unfit to be worked tends to impair the physical character of the soil. Experiments have shown that commercial fertilizers will not always reclaim lands which have been treed, whereas barn manures and green crops may go very far towards revitalizing them. As a result of inability to grow vigorous stock on treed land, a large part of the nursery stock of the country, particularly fruit trees, is grown on rented land. On the nurseryman's central grounds a variety of stock may be grown, chiefly ornamentals, but the larger part of the commercial fruit stock is farmed out to persons who are willing to rent their land for this purpose and who will give the requisite attention to the growing trees.

The industry has developed special tools without which nursery stock cannot be grown on a commercial scale. The simplest of these are budding- and grafting-knives of various kinds to meet the needs of different plants and the whims of users. There are also special hoes for planting and spades for digging, the latter with



2537. View in an American apple tree nursery.

strongly reinforced handles and heavy blades of the best steel. Several tools in common use in subsoiling and cultivating are peculiar to nursery work. Still more specialized are the tree-diggers, requiring considerable power, drawn usually by four to eight teams, by traction engines, or by stationary engines at the end of the row which draw the digger by winding up a cable on a drum. Fall digging makes it necessary to strip the leaves of many trees, a task formerly performed by hand, but many growers now strip in a specially made machine after the trees are dug. Besides these, various devices are used in packing and boxing.

Winter storage. (U. P. Hedrick.)

Nurserymen in the North almost universally dig tree-, bush- and vine-fruits, as well as many ornamentals, in autumn and store through the winter in frost-proof houses of one kind or another. The best of these houses are built much as are cold-storage plants—in fact, some have facilities for refrigeration. By far the greater number of them, however, are storage cellars. The objects gained by winter storage are protection against mice and rabbits, prevention of injury through freezing and the wide fluctuations in temperature in northern winters, and greater convenience in making spring shipments. The most satisfactory results are secured when the stock is kept at a uniform temperature as near freezing as possible. Thus, at 28° to 34° F., above zero, very little ventilation is necessary, the trees dry out and shrivel but little, there is a minimum tendency to mildew, and packing material about the roots and spraying with water are usually not necessary. At lower temperatures, injury from freezing begins, and at higher ones the storage-house must be ventilated, the trees sprayed, their roots protected, and fungi do serious damage. Undoubtedly the storage of stock benefits the nurseryman more than the fruit-grower; for it is because of the drying out, more or less of which

always takes place, or other injury in poorly managed storage, that trees so often come to the grower with barely the breath of life.

The extent of the nursery business.

Statistics covering the general range of the United States nursery business were published in Bulletin No. 109 of the Eleventh Census (for 1890). The census enumerated the items of 4,510 nurseries, occupying 172,806 acres and representing a valuation of \$41,978,835.80. The total capital invested was about \$52,500,000. These establishments employed 45,657 men, 2,279 women, and 14,200 animals. The total number of plants and trees was 3,386,858,778, which figure does not include unenumerated plants on 1,477 acres of nursery grounds. Of this enormous total, fruit trees comprised 518,016,612 plants, and grape-vines and small-fruits 685,603,396. Apple trees alone, the highest figure given for a single species, numbered 240,570,666. It is probable that these early figures are not comparable in statistical value with those of succeeding censuses. It would be interesting to speculate as to the destiny of these trees and plants. It is safe to assume that each plant in this uncountable number was the subject of thought and solicitude on the part of the propagator; yet it is probable that not one in a hundred has lived to bring satisfactory reward to the buyer. It has been estimated that the apple trees standing in orchards in the United States at the close of the century were 100,000,000, or less than half the number growing in the nurseries in 1890. The elements of loss are many, but the greater part of the failures occur after the stock has passed to the hands of the final purchaser.

In the Twelfth Census (1900), "there were 2,029 commercial nurseries in the United States. Within the past decade many small nurseries have been consolidated and numerous others have been absorbed by the larger companies." "In many of the western states the owners of large orchards propagate from the standard varieties they have on hand the stock they require in enlarging their acreage of fruit trees. This has not been taken into account in compiling the statistics of nurseries because the income from this labor would be credited to sale of fruit and not to sale of trees." The total area was 165,780 acres, with 137,459 acres, or 82.9 per cent, improved. The average size of the nursery establishments was 81.7 acres, although a number of 500-acre tracts were operated. "The value of land, buildings, and other improvements was \$18,144,073, the former value being \$13,880,820 and the latter \$4,263,253. The average value an acre of the land was \$84. The value of buildings was much smaller for the nursery establishments than for the florists' establishments, and the value of live-stock much larger. This is due to the fact that nursery operations are much the same as in other farming. The value of implements was \$539,895 and of live-stock, \$462,013. The total value of products was \$10,086,136 and \$139,512 was expended for fertilizers and \$2,305,270 for labor. One of the heaviest expenses of the nursery growers was that for labor, the amount constituting 22.9 per cent of the value of the product, a much larger proportion than is involved in the raising of other crops, except flowers and plants. The total value of products comprised \$9,231,503 from nursery stock and \$854,633 from general farm produce. Distributed among the 2,029 establishments reporting, it gives an average value of product of \$4,971. The value of products fed was \$192,999, a considerably larger proportion than for the florists.

"Of the several geographic divisions, the North Central ranks first, many new nurseries having been established to meet the greatly increased demand for nursery products in the West. In the North Central division there were 836 establishments, with a total value of products not fed to live-stock of \$3,892,668.

The number of establishments and the value of products not fed to live-stock for the other divisions are: North Atlantic, 496, \$3,076,241; South Central, 287, \$1,347,253; Western, 241, \$944,289; South Atlantic, 169, \$825,685. New York leads in the quantity of nursery stock produced, being credited with over half of the total reported for the North Atlantic division. For many years the state has been prominent in this industry, it now having 237 establishments and products valued at \$1,703,354. Some of the other leading states, in value of products, are: Iowa, \$636,543; Illinois, \$610,971; Ohio, \$538,531; California, \$533,038; and Pennsylvania, \$515,010.

The Thirteenth Census (1910) reports the acreage in nursery products in 1909, as 80,618, "showing an increase of 35.5 per cent since 1899, while the value of the products more than doubled during the decade, amounting to \$21,051,000 in 1909. The average value per acre increased from \$170.17 in 1899 to \$261.12 in 1909. Of the total value of nursery products 98 per cent was reported by 2,470 special nursery establishments, the aggregate value for such establishments being \$20,620,000, and the average per establishment \$8,348. The value of nursery products in 1909 was over \$1,000,000 in every division except New England and the Mountain divisions. The Middle Atlantic division, with a product of \$4,355,000, ranked first, followed in order by the West North Central and Pacific divisions each with a product valued in excess of \$3,000,000. The three leading states in this respect were New York, with \$2,703,000; California, with \$2,135,000; and Texas, with \$1,236,000; no other state producing as much as \$1,000,000 worth."

The nursery interests of this country are represented in a strong organization known as the American Association of Nurserymen, which holds a movable annual meeting in June and publishes a report (see page 1553). There are also societies representing geographical regions. At the present time, there is one periodical devoted to the nursery business, "The National Nurseryman," which is published monthly at Rochester, New York. The American current book writings devoted specifically to the business are Fuller's "Propagation of Plants" and Bailey's "Nursery-Book."

L. H. B.

NUT-CULTURE. Seeds with a hard shell and edible kernel, which are classified colloquially under the head of nuts, are borne chiefly upon trees or shrubs. A few species of annual plants furnish nut crops. In most parts of the world nuts have been collected chiefly from wild seedling trees, but in some countries the hazel, the almond, and the walnut in particular have been grown in orchard form since very early times. Such grouping offers better facilities for cultivation and for gathering of the crops.

It is probable that the almond, which is very easily budded, has been subjected to that process since the days of the Romans. More recently the hazels and the walnuts have been propagated by budding and by grafting in the European countries. The larger part of nut orchards, however, have consisted of seedling trees of selected varieties. In the latter part of the nineteenth century there developed a widely extended movement, including several countries, toward grafting or budding particularly desirable varieties or species of nut-bearing trees or shrubs upon appropriate stocks. A still more advanced procedure,—that of hybridizing,—for the purpose of combining characteristics of especially desirable kinds, belongs almost peculiarly to the twentieth century. Nut-bearing trees which are chiefly wind-pollinized have been so extensively crossed in nature that few of them breed true to seed. They are much like the apple in this respect. The new movement of artificial pollinizing promises to accomplish for the nut-tree what it has

accomplished for many other kinds of fruits. A notable development of the industry of nut-raising may be anticipated as a result of the application of modern methods.

Some species of trees, like the coconuts and the nut-bearing pine trees, apparently gain little or nothing from cultivation. Almonds, chestnuts, hickories, hazels and walnuts, on the other hand, are remarkably susceptible to influences of cultivation, and they respond with crops which are valuable largely in proportion to the degree of skilled attention which has been given by the horticulturist. Species of trees which have not as yet been cultivated for man's purposes, although valuable in some cases for mast crops for animals, will presumably be given much more attention in the future. Certain kinds, like the beeches and the oaks, may eventually furnish large quantities of food for man. Acorns, while rich in protein, fat and starches, contain in addition disagreeable elements like berberine or tannin in excess. These elements may be bred out to a greater or less extent by horticulturists. The horse-chestnuts of various species which bear heavy crops of nuts, valuable in food-content, are little used except by the Indians, who crush the nuts and wash out the soluble elements which are undesirable. It is probable that chemistry will eventually solve the question in such a way as to allow this group of trees to be grown for food purposes more generally.

Among the desirable kinds of nut-trees which have already been subjected to cultivation, it is found that grafting and budding bring out certain characteristics belonging to those of other fruit-trees, when subjected to the same process. There is apparently a tendency toward precocious bearing, and the grafted or budded nut-trees appear to be more prolific than others, and perhaps to be shorter-lived in consequence. A number of species of nut-trees which do not bear naturally until they are fifteen years or more of age as seedling trees, may begin to bear in one to three years after grafting or budding upon other stocks.

The methods of grafting or budding are in general those which are employed for other fruit-trees, but rather more expert work is required on the part of the horticulturist, and several factors have to be taken into consideration. In grafting or budding nut-trees which have particularly hard wood, very accurate work is required for the purpose of getting the cambium layers of stock and of insert neatly adjusted. The slow callusing of hardwood trees of this group requires particular care in the method chosen for protecting the inserts against drying out before granulation is completed. Some of the nut-trees, walnuts particularly, have such a free flow of sap that the method of placing inserts must be so adapted that this sap is allowed to escape freely, otherwise the dammed sap decomposes and destroys the callus.

The question as to whether grafting or budding is particularly desirable for any one species of nut-tree has not yet been determined. Some of the nut-tree growers in temperate regions prefer grafting in the spring, while others are convinced that August budding gives best results. Under these circumstances one is probably dealing with a matter of individual proficiency and skill, rather than with any fundamental principle in plant physiology which is involved in the question. Cions which are to be employed for spring grafting of nut-trees are best cut in the autumn. They may be stored in densely packed leaves or kept in cold storage until the following season. Sometimes they may be buried in sand. There is danger from the effects of too much moisture when cions are kept in sand, because the protoplasm of buds becomes senescent or undergoes chemical change when carrying a full charge of water. For August budding, two methods are employed. The leaves of the prospective bud-stick are cut off, leaving the petioles in place. At the end of a few

days these petioles usually separate and fall away, leaving buds which are more readily handled. Other orchardists prefer to leave the petiole in connection with the bud and to transfer both directly to the stock. In any case it is important to make use of one principle,—the principle of bringing the bud to a state of rest for a few days. This is best accomplished by placing the green bud-sticks in the ice-house or in cold storage for three or four days. The effect of the cold is to bring the life processes in the buds to a pause, and then when transferred to stocks the buds start off into activity in a more kindly way than when transferred without a resting-period.

The choice of grafting-stocks is one of considerable importance. Almost any species or variety of nut-tree may be grown upon stocks of allied species and varieties, but in dealing with the hickories it is desirable to note the wide variation in character and texture of wood between different species. Thus the pecan, an open-bud species, will perhaps be found to thrive best when grown upon stocks of the bitternut (another open-bud species), excepting when it is more desirable for any reason to place a variety of pecan upon stocks of its own species. The shagbark hickory appears to do best upon stocks of shagbark, mockernut, shellbark or pignut. In chestnut-grafting, the various European, Asiatic and American examples are best grown upon stocks of their own kinds respectively. Some of the Asiatic species, for example, do not make firm ligneous union at the site of an insert upon an American stock. American chestnuts grafted upon European kinds are prone to make excessive growth without firm ligneous union, at least during the first two years. Sometimes wild nut-trees are grafted or budded with particularly desirable kinds, and this may be profitably accomplished if the wild trees are well headed back during the winter time, and new sprouts allowed to start in the spring. Grafting or budding is done upon the new sprouts subsequently. This work demands very much attention on the part of the horticulturist, because the large quantities of new shoots which start out from a mature tree may deprive grafted or budded sprouts of their sap. When the grafting or budding is to be done upon small stocks in the nursery, there is some question as to whether these stocks may be best grown where they are to remain permanently, or whether it is desirable to subject them to cultivation in close form for two or three years, and then transplant.

There is a tradition among horticulturists to the effect that nut-trees in general are not readily transplanted. This is not strictly true, but it includes the idea that much more care must be exercised when transplanting species of trees which have not as yet been brought under subjection through many generations of cultivation. The Stringfellow method of severe trimming back of the head and root, without any attempt at saving small fibrous roots, has been the most successful method with some horticulturists when nut-tree stocks were to be transplanted.

The choice of soil is an important matter in the growing of nut-trees. Chestnuts and hazels, for example, will thrive in soil that is somewhat acid, while walnuts and some of the hickories are insistent upon having neutral or alkaline soil. Species which naturally prefer neutral or alkaline soil will thrive very well as older trees upon soil that is slightly acid, provided that a little lime be added to the soil during the first four or five years of growth of the tree. Nut-trees, for the most part, when grown in orchard form, should be given the character of soil which wild trees of the same species are known to prefer. Lime in the soil is thought to improve the quality of many of the nuts, and in the best walnut orchards of France it is sometimes applied annually, even upon soil which is already neutral or alkaline in reaction.

Among the nut-bearing annual plants, various species

of lotus and the water caltrops furnish an important food-supply in some parts of the Orient, but these are not as yet subjected to cultivation, and they have been neglected as sources of food-supply in America, although they are grown here in many places chiefly for their flowers or as curiosities. Large areas of our shallow fresh waters are suitable for growing such crops of the water caltrops and several species of lotus. The peanut, as a nut-bearing annual plant, is being cultivated successfully over an increasingly large area in different countries, and promises to furnish a permanently valuable food-supply.

The nuts of trees and shrubs which are to be planted require treatment somewhat different from that of other seeds. In nature they are prone to await suitable conditions of warmth and moisture which are quite out of the ordinary, before sprouting. In temperate regions the most successful method, perhaps, consists of storing them for the winter in cages made of galvanized wire about 8 inches deep, sunk about 4 inches beneath the surface of the ground, and the interior of the cages filled with sand to the ground-level. Nuts which are to be grown in the following season are pressed into this sand in rows, closely together but not wholly covered with sand. A loose mulch of leaves is tossed over them and the wire cover of the cage closed in order to protect them against rodents. These nuts are allowed to freeze and thaw during the winter and spring. In the spring the mulch is removed, allowing the exposed side of each nut to be warmed by the sun while the buried part is kept moist. Under such conditions almost every nut of species belonging to temperate regions will sprout. As rapidly as the nuts sprout, they are transferred to the nursery row and cultivated for two or three years before being transferred to permanent sites as seedlings or as grafted stocks.

For illustrations of methods of budding nut-trees, see page 1366, Volume III; also the article *Pecan*.

ROBERT T. MORRIS.

Culture of the different kinds of nuts.

From the earliest times, nuts have been used as an article of food in North America. The prehistoric tribes left evidences of their use in the specimens which were buried with their remains. When the white settlers came, they found several kinds of nuts growing wild and bearing abundantly, and thought to introduce the cultivated nuts of Europe along with fruits and farm crops that seemed to flourish in the virgin soil. But little success seemed to attend their early effort, largely because of the unsuitability of the varieties tested. The sweet almond and the hazels were found to be of this character, and the few experiments with the European walnut and chestnut, where they did succeed, were not followed up by extensive plantings for many years. Nor were any of the native nuts brought under cultivation until very recently. Now there are many orchards and groves of both foreign and native nuts, some of which are already yielding profitable crops.

The almond (Prunus Amygdalus).

Among the first nuts to be tested were the cultivated almonds. All the experiments up to the present day lead to the conclusion that the choice varieties are not suited to any section east of the Rocky Mountains, except, perhaps, in southwestern Texas and New Mexico. The close relationship to the peach would cause us to expect that it would succeed wherever that fruit does; but the trees of the choice varieties are too tender to endure any but very mild climates, and the fruit-buds are still more tender. The chief failing, however, is the habit of very early blooming, which causes the crop to be cut off by spring frosts, except in pecu-

liarily favorable localities. There are differences in the ability of the varieties to endure cold, and in time of blooming, even where they are counted a success. Not until seedlings were grown and tested, from which selections were made of suitable kinds, did the growing of this nut prove profitable.

At the present time the culture of the almond is confined chiefly to California. To some extent it is grown in Utah, Idaho, Arizona and New Mexico, and fair crops of the highest quality in all respects are grown there. There are single orchards in California of hundreds of acres in extent. The average crop of the region is estimated to be about 3,000 tons or 6,000,000 pounds, and in view of the large quantities of almonds imported there is room for a large increase in production. This is being met to a considerable extent by extensive plantings in California. It is thought that the production of new seedlings will still further overcome the weak points already mentioned, and materially extend the culture of really choice varieties to some extent. The varieties being grown are nearly all of California origin and are Nonpareil, I X L, and Ne Plus Ultra, and are esteemed for market in the order named. Drake, Texas Prolific and Languedoc are also prized, especially for shelling, but their price is not equal to that of the others named. The methods of planting and cultivation of the soil are about the same as for the peach. Twenty to twenty-five feet is a good distance apart for planting the trees in rich soil; sometimes they are set as much as thirty feet apart. In the state of California, they are frequently set in the quincunx form. See also *Almond*, Volume I.

The walnuts.

American walnuts.—The kernels of all species of the walnut family are liked because of their rich and delicious flavor; but some of them are so small and difficult to get out of the shell that they are of little or no commercial value. Our native black walnut, *Juglans nigra*, and butternut, *J. cinerea*, are of this character. At present there are very few trees of either species that are grown for their nuts; but there are some prospects of improvement in this direction.

Asiatic species.—Within the last forty years there have been introduced from Japan two new walnuts, *J. Sieboldiana* and var. *cordiformis*, and from Manchuria one, *J. mandshurica*. These make beautiful and stately trees, but the nuts of all but *J. Sieboldiana* var. *cordiformis* have too thick shells to be of much value. See *Juglans*.

Persian species.—The Persian walnut, *J. regia*, which has long been called English walnut and by several other titles, has been cultivated for many centuries for its thin-shelled and richly-flavored nuts. It is a native of Persia and the regions about the Caspian Sea. The Greeks and Romans took it to southern Europe before the Christian era. It was brought to America in the early settlement of the country, but did not succeed everywhere, and the few trees that survive in the eastern states have been mostly neglected. Some of them have borne nuts abundantly and others have not. Unproductiveness has generally been due to the isolation of the trees and the inopportune times of the blooming of the flowers of the two sexes. These isolated trees are scattered over the eastern states from New York to Georgia, and rarely beyond the Appalachian mountain chain, because of the more uncongenial climate there.

Regions of successful culture.—On the Pacific coast the Persian walnut is a great success, especially in southern California. True enough, there are some failures, but they are mostly due to lack of proper pollination, a matter which can and will soon be generally understood and overcome. There are extensive orchards already in bearing, and with the advantages which are now being afforded by the introduction of the best varie-

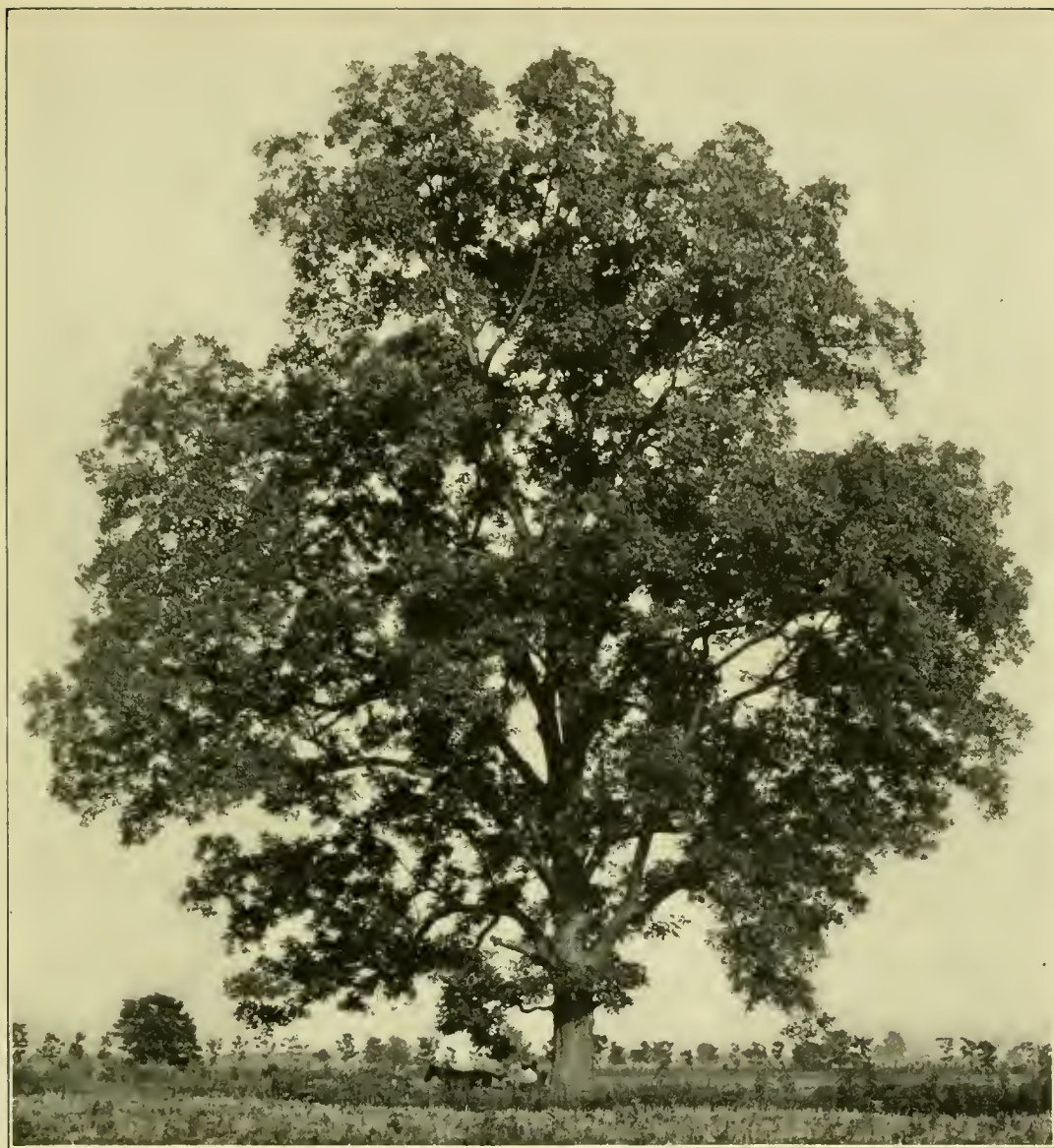
ties from Europe and the origination of improved seedlings, the walnut industry is sure to advance rapidly in that region. The soil of the richer valleys of the Pacific slope is just what is needed, and where there is an abundant supply of water a few feet under the surface there is no need of irrigation. But in poor, dry soil it is folly to expect success. The crop of California alone, in 1910 was about 10,000 tons or 20,000,000 pounds, or 1,000 carloads of 20,000 pounds each. It is confidently expected that California alone will, within a few years, produce all that our home markets require. Recently a very deep interest has developed in walnut-culture in the Atlantic States, as some of the hardiest and most fruitful seedling trees have come to be appreciated, are given varietal names and are being propagated by the nurseries. As yet there are very few trees planted out in orchard form, but there are a few small orchards of such trees, mostly in New York, New Jersey and Pennsylvania, and there are larger ones of seedlings of these improved strains, some of which are in profitable bearing. There seems to be good reason for believing there will be a thriving industry in walnut-culture in the Atlantic States and possibly farther to the westward within a few years to come. But the experiments with *J. regia* have not been very favorable to it in the central or Mississippi Valley regions west of the Appalachian Mountain chain, perhaps owing to the changeableness of the climate.

Propagation.—The larger number of bearing trees are seedlings, but those grafted or budded with choice varieties are far preferable, and such trees will form the walnut orchards of the future. The native black walnut, *J. nigra*, is the species used as a stock principally in the eastern states and it serves the purpose very well. *J. rupestris*, a species native in Texas and adjacent regions, is also used as a stock, especially in the South, and the varieties of *J. regia* grow very well on it. This native species is closely allied to *J. californica*, which is now used in California, Oregon and Washington as a walnut stock more than any other species. *J. cinerea* is being tested in a small way for this purpose, and so are the Asiatic species, but so far with uncertain results. The planting of seedling walnut orchards is giving way to those of the named varieties, of which there are many and among them several that have proved to be reliable bearers and their nuts of standard commercial value. Although some seedlings are grown and sold by the nurseries, they are becoming unpopular. There are a few small nurseries both East and West now devoted almost entirely to the growing of grafted and budded walnut trees.

Planting and culture.—The distance for the trees to stand apart in the orchard is from 40 to 60 feet, according to the vigor of the variety and the richness of the soil. Clean tillage is best for the trees until they reach bearing age, when the ground may be seeded to some grass that does not make a compact sod. If hoed crops are grown between the trees until that time, it will do no harm and economize the space. Almost no pruning is needed for this tree, except to keep the branches from getting so low as to interfere with tillage. The trunk should be 4 to 5 feet high. See *Walnut*, Volume VI.

The chestnuts.

American species.—Like the walnuts, our native chestnuts are not so desirable for market purposes as those from foreign countries. The wild American chestnut, *Castanea dentata*, is richer in quality than any foreign kind, but the size is less than half that of the introduced nuts. Throughout the larger part of the eastern United States, and extending into lower Canada, there are untold millions of native chestnut trees, yielding a wealth of nuts that find ready sale in the markets, so far as they are gathered; but the prices are only about half those of the large cultivated and imported product. At the present time there are but



LXXV. Nut-culture.—The original (native) tree of the Butterick pecan, in Illinois; a commercial pecan plantation in Georgia.

few attempts made to cultivate this species. Some of the choice varieties with the largest nuts are being collected for experiment, and there is reasonable prospect that by hybridization and selection of seedlings varieties may yet be secured combining the vigor and hardiness of the wild trees with the characteristic natural sweetness and large size of the foreign nuts. Within the last few years, there has been developed at least one very choice variety of our native species that is surpassing in general desirability to all others, either native or foreign. This is an accidental seedling that originated from among a lot of nuts planted by Charles A. Green in his nursery near Rochester, New York. It was sent to E. A. Riehl, of Alton, Illinois, and it grew vigorously and when it came to bear, to his surprise the nuts were very much larger than those of the average of the American species, although possessing the natural outward appearance and sweetness of kernel that are characteristic. This variety was named the Rochester. The nuts nearly all ripen at one time and part from the burs easily. Some of its seedlings are said even to surpass the parent.

The chinquapin, *C. pumila*, is the smallest of the chestnut family, in size of both nut and tree. Rarely is it anything more than a mere bush. It has rarely been cultivated, although the bushes are productive, the nuts of good quality and ripen very early.

European species.—The Old World chestnut, *C. sativa*, has been under cultivation almost as long as history goes. It was brought to America in the first century of its settlement by Europeans; but not until within the last twenty-five years has there been more than an occasional tree found on our shores. The accidental finding of a chance seedling, which was finally named Paragon and sent out to the public about 1887, and the bringing to notice of the Ridgeley shortly before that time, were the means of exciting the first general interest in chestnut-culture in America. Both these kinds, and a great many more named varieties, are now being propagated and scattered far and wide. They are all of large size but not so sweet as our native chestnuts, and generally have bitter skins. The trees are of robust character and very productive, but more tender than our natives.

Japanese species.—About the time that the European species was becoming popular in America, attention was drawn to a number of seedlings from nuts that had been brought from Japan during several previous years. The most of them were larger than any that had been known before, either in this country or in Europe. Many of them are now named and widely distributed. Some of the smaller varieties are exceedingly early in ripening. Nearly all of them begin to bear at an early age and are even more productive than the average of the European species. In quality, the nuts of most of them are not so sweet as the European kinds. The habit of growth is less vigorous than that of other chestnuts and the foliage much smaller.

From these two foreign species have been obtained nearly all of our varieties that up to this time are worthy of general cultivation, except the Rochester. They vary from seed much as do most other improved varieties of fruits, and grafting and budding must be practised, which are exceedingly difficult successfully to perform on the chestnut, as is the case with all other nut-trees. They will both unite fairly well with our native stocks; although sometimes the union is imperfect and the top breaks off.

Grafting.—The most successful method of propagating nut-trees, so far as the writer has experimented or learned otherwise, is kite bark-grafting. This requires that the cions be cut before there is any possibility of the buds starting, and put in some very cool place until after the stocks have begun to leaf out. The stocks are then cut off as for cleft-grafting, but the bark only is split with a knife for an inch or more at the top of the

stock. The cion is trimmed to a long wedge, all from one side. The point of this wedge is introduced under the bark at the top of the slit and gently forced down until the cut surface of the cion is even with the top of the stump. It is then tied fast with a string and the wound securely waxed. Large trees may thus be top-worked in their branches with considerable success. Small stocks should be grafted just under the surface of the ground and banked nearly to the top of the cion.

Stump groves.—In several cases, large tracts of chestnut stump lands have been grafted over to the improved varieties of the foreign species with good success. All other trees should be cleared away and only two or three of the strongest sprouts left on each stump. These should all be grafted and allowed to grow until it is sure that there will be a sufficient stand, when those that are not needed should be cut away. In future years more may be cut away to give the remaining trees ample room.

Chestnut orchards.—The best results are said to be attained in chestnut-culture by planting grafted trees on open land, about 40 feet apart and in regular orchard form. This plan admits of giving the trees good tillage until they have attained large size, when grass may be sown and stock allowed to graze it, except when the nuts are falling. Such orchards are said, by those who have tried them in comparison with grafted sprouts, to yield more than twice as much to the acre. Well-drained sandy or shaley lands are the best for the chestnut.

Pests.—A fatal fungous disease has become very prevalent within recent years in the eastern United States. It began on the North Atlantic coast and has gradually moved southwestward until there is scarcely a locality north of southern New Jersey and Pennsylvania where it is not prevalent. In some places the cultivated and wild chestnut trees have been practically exterminated. There seems to be no practicable means of combating this disease, and it is feared that the entire area in the eastern states where the chestnut is found will be reached by it and may be ravaged. Another enemy of chestnut-culture is the weevil. In some cases the nuts are so badly infested that they are practically worthless. The eggs from which the larvae develop are laid by long-snouted beetles while the nuts are growing, and by the time they are mature most of the eggs are either hatched or nearly ready to hatch. By treating the nuts with the fumes of bisulfide of carbon the eggs or larvae can all be destroyed. Scalding with boiling water for about ten minutes will also kill them, but it also destroys the germinative power of the nuts and necessitates drying them. Outside the native chestnut area, there are no weevils as yet. See *Castanea* and *Chestnut*.

The pecan (Carya Pecan).

In the wild state.—Of all our native nuts the pecan is the best. Its natural habitat is the lower Mississippi basin, from Iowa to the Gulf coast, but it will grow equally well in any climate and soil of approximately the same character. The tree is almost as hardy as any of the other hickories, except some of its more southern varieties. In size the tree varies from medium, on land of ordinary fertility, to gigantic proportions on the rich river and creek bottoms. The nuts vary in size and shape from round and $\frac{1}{2}$ inch in diameter to oblong and 2 inches in length. The kernels are exceedingly rich and sweet, and the shells usually thin. Pecans are found in all confectionaries, and bring almost as high prices as any of the imported nuts. The largest quantities of native nuts are secured from Texas and Louisiana. Millions of pounds are gathered annually in those states and sold to dealers, thus bringing a handsome revenue to many persons of moderate means.

Under cultivation.—The decrease of the wild product from the cutting down of the trees, and the better prices obtained from large, thin-shelled nuts have induced the planting of pecan orchards. The nuts

sprout readily, and the trees are of easy growth, with reasonable care, in proper soil and climate. Orchards of 10 to 1,000 acres are planted in the southern states. There are many smaller orchards planted in nearly all the states from Virginia to Missouri and California, southward. The line of 40° north latitude is about the limit of successful pecan-culture, and the region from 35° southward is much better. The nuts do not fill and ripen well where the growing season is short. It has been learned that by cutting back the tops of wild trees (thus causing an abundance of sprouts), and then budding in August or September, large trees may be quickly transformed into such as will produce the highest grade of nuts.

Planning the orchard.—There is a division of opinion as to the advisability of planting the nuts where the trees are to stand and rearing them for a year or more



2538. Coconut, the most important of tropical nuts.

in a nursery. Both ways are good, but each has its advantages. If the former of these plans is followed, then two or three nuts should be planted where each tree is to stand and a cedar or cypress stake driven at the spot. Pine stakes are said to induce worms to attack the little pecan trees. A still safer plan is to enclose the little seedlings in narrow boxes about a foot high, made of cypress boards. This secures them from the depredations of rabbits, which sometimes prove very destructive. By this plan there is no labor or danger of loss by transplanting. All but one of the trees should be removed after two or three years' growth. If the nursery method is followed, the transplanting should be done at one of these ages. Mulching the trees with old trash is very beneficial to them.

Propagation.—Grafted or budded trees are far preferable to seedlings, because of the certainty of the variety, convenience of gathering the nuts at one time, and the advantage of having an even and high grade to sell. The same difficulty is met with as in case of the

chestnut—the trouble and expense of securing grafted or budded trees. However, it has been found that both these methods of propagation are reasonably successful in skilful hands. Either the cleft-, tongue- or bark-graft will succeed, but the two former styles do better on small stocks just below the surface of the soil than above. Probably the most universally successful method of propagating the pecan is that of the bark-graft, although experienced nurserymen more largely employ the patch-bud. Trees with unions a foot or more above ground are much less subject to winter injury than are root-grafted trees.

Planting and cultivation.—The distance for planting should not be less than 50 feet between trees, because they get to be very large, and 80 to 100 feet is better. Thorough tillage will pay abundantly and should never be neglected while the trees are young. Farm crops, such as corn, cotton and potatoes, may be grown between the trees until they begin bearing, which is from 6 to 12 years from planting.

Varieties.—There have been wonderful developments in the discovery and production of choice varieties of the pecan within the last twenty-five years, and especially within the last decade. The first variety to become popular and one which is now held in high esteem is the Stuart. It originated from a nut planted on the coast of Mississippi and was brought before the public by the late W. R. Stuart of Ocean Springs, Mississippi, after whom it was named. The next one of note to be brought forward was the Van Deman, which originated from a nut planted in St. James Parish, Louisiana, near the bank of the Mississippi River fully fifty years ago. The tree is yet in full vigor and bearing abundantly. These two varieties have been the parents of thousands of seedlings, some of which have become famous already and others are constantly coming forward, even of the second and third generations. Among the principal varieties now being grown in the South, are the Alley, Bradley, Colorado, Curtis, Delmas, Frotseher, Halbert, Kincaid, Moneymaker, Pabst, President, San Saba, Schley, Sovereign, Stuart, Success, Taylor, and Van Deman. The best of the northern varieties are the Busseron, Butterick, Green-river, Indiana, Major, Niblack, Norton, Posey, and Warrick. With the exception of the Norton, which originated in eastern Missouri, the varieties of this latter group are from the vicinity of Evansville and Vincennes. See *Carya* and *Pecan*.

The coconut (Fig. 2538).

There is comparatively little territory on the continent of North America where the coconut will grow; viz., a small portion of Florida and the warmer coast regions of Mexico. In the warmer parts of California the climate does not seem to be sufficiently humid. In the vicinity of Lake Worth, and Biscayne Bay, Florida, there are many bearing trees, and along the east coast and adjacent islands from there to Key West, and as far north on the west coast as Charlotte Harbor, there are many thousands of coconut trees growing. In central Florida the climate does not seem to be suitable. Proximity to the sea in all countries seems to suit the coconut best. It will flourish in almost any soil, although the richer the better, but a warm and humid atmosphere is indispensable.

Origin of coconut-growing in America.—The oldest coconut trees in Florida were probably chance seedlings which came from nuts that washed ashore from the sea long years ago. Such trees are very rarely found. There are also a few old trees that grew from nuts planted by settlers at Key West and other places along the coast. The chief cause of the impetus to coconut-growing was the wrecking of the Spanish bark *Providencia*, laden with coconuts, on the beach near Lake Worth, Florida, January 9, 1878. Many thousands of the nuts were gathered from the surf and planted

for many miles up and down the coast. The trees grew so rapidly and began to bear so soon, usually at from six to eight years from seed, that visions of wealth tempted many more into planting groves. One near Biscayne Bay consisted of about 4,000 acres, in which were 300,000 trees. Another at Cape Sable contained 42,000 trees, and there are many more of less extent.

Present status.—Cold waves and occasional frosts have injured many of the coconut trees, in some cases killing them outright. In general, the trees bear good nuts in reasonable quantity, but in a business way the industry is uncertain, owing to danger from frosts and the cheapness of imported nuts. As an interesting novelty, the coconut in southern Florida is an eminent success. See *Coconut*.

Nut-culture in New Mexico. (C. P. Wilson.)

In the newer parts of the country to which commercial nut-growing is adapted, the development of this industry will be coincident with that of the country itself rather than an addition in after years. As an indication of the outlook on nut-culture in new regions, this note is inserted on the industry in New Mexico; and what is said of this state will undoubtedly apply very well to Arizona and adjacent regions.

Much attention has not been given, so far, to nut-culture in this state, though a few small experimental orchards of pecans, as well as a number of almond and Persian (English) walnut trees, have been set out. Most of these are in the irrigated valleys of the southern part of the state. The climate of this state is well suited for the heavy fruiting of pecan trees that have originated near the western limit of the region to which this species is indigenous. Many of the large seedling trees to be found in different parts of New Mexico are very prolific. However, most of the early attempts to transplant either the seedling trees or those that had been budded or grafted were unsuccessful. This appears to have been due largely to the fact that sufficient precautions were not taken to prevent the young trees from dying back during the dry winters that usually prevail in this part of the Southwest. Attempts along this line during the past few years have been more successful, and it is believed that, by keeping the ground very moist during the winter, much of the damage can be prevented. Hilling up the soil around the trees of some varieties the first few winters after transplanting would also, no doubt, be advisable, as an additional protection. It is doubtful whether the pecan will do well where there is much alkali, or where the water-table is within 8 or 9 feet of the surface. Growth will probably be better on land that has been cultivated for several years than on new ground. Varieties suitable for southern New Mexico are the Sovereign (Texas Prolific), Hollis, and Halbert; while for the northern part of the state, sorts that originated farther north, such as the Indiana, Kentucky, and Warrick, might do better. Coast varieties and southern varieties that originated east of Texas are not recommended at present for any section of the state, though some of these might do fairly well. It is probably better to transplant the budded or grafted trees, rather than to grow the seedlings with the idea of topworking them later. While the pecan can be budded in this climate, the operation has to be conducted carefully if success is to be expected.

It is quite possible, or even probable, that varieties of Persian walnuts will, in time, be found that will grow well in this state. The climate of New Mexico is not so well suited to the Persian walnut as to the pecan. The leaves of the former are inclined to sunburn during the summer, and some injury may occur to the young growth during the winter or early spring. There are at present a few trees in the southern half of the state that are in bearing. Some of the nuts are of good size, but no data are available concerning the yield.

The early blooming habit of the tree prevents the

production of almonds on a larger scale. However, recent experiments have proved that a few of the commercial varieties of almonds are little, if any, earlier in this respect than the Elberta peach; though most of the almonds bloom entirely too early to be of any importance in this region. The tree grows well in the irrigated valleys.

There seems to be no record of experiments having been conducted with chestnuts, but on account of the fact that New Mexico soils, on the whole, are rich in lime, this tree would probably not do well. It is also doubtful whether filberts could be grown successfully in this climate.

Literature.

There are several American publications devoted exclusively to nuts: Stewart, H. L., "The Pecan and How to Grow It," 1893; "Nut Culture in the United States," 1896, being a bulletin of the Division of Pomology, United States Department of Agriculture; Fuller, "The Nut Culturist," 1896; Lelong, "California Walnut Industry," 1896; Parry, "Nuts for Profit," 1897; Risien, "Pecan-Culture for Western Texas," 1904; Hume, "The Pecan and its Culture," 1906; Wight, "Pecans," 1906; Price, E. M., "The Walnut," 1910; Allen, W. F., "English Walnuts," 1912.

An important part of the current literature of nut-culture is contained in the reports of special societies. The National Nut-Growers' Association issues publications: see page 1554, Volume III. The Northern Nut-Growers' Association issued the Report of its Third Annual Meeting in 1912, comprising a publication of 140 pages; secretary and treasurer, Georgetown, Conn. There are also journals devoted wholly or in considerable part to nut-culture: See periodical list, pages 1560, 1561, Volume III.

H. E. VAN DEMAN.

NUTMEG: *Myristica*.

NUTS. In popular usage a nut is a hard vegetable product, usually a fruit, inclosing an edible part within a shell; and the edible kernel or meat is released by breaking the integument. Technically or botanically, a nut is a hard and indehiscent one-seeded pericarp arising from a compound ovary; but it is hardly to be expected that this very special use can prevail as against the long-established popular usage. In this article, the word nut is understood in its popular or usual application; it may be difficult to define, but it is readily understood.

The purpose of this catalogue, by C. A. Reed, is to name and describe all the nuts that are likely to be found in commerce in this country or which may be subjects of rather common inquiry. Not all of these nuts are grown or cultivated in this country and therefore some of the genera may not be found elsewhere in the Cyclopaedia; that is to say, this is not a cultural article but only descriptive and is independent of any alphabetical entries elsewhere in the work. For the cultivation of nuts as practised in North America, see the article *Nut-culture*.

L. H. B.

Æsculus Hippocastanum. HORSE-CHESTNUT. *Hippocastanaceæ*. Inedible seeds, about equal in size to the largest of the European chestnuts, but less regular in form and having a somewhat stronger and more shining shell. Borne in a one- to three-celled prickly pod. The fruit of an ornamental tree familiar in the North Temperate Zone, of both the Old World and the New.

Aleurites spp. WOOD-OIL NUTS of China and Japan. LUMBANG of the Philippines. CANDLE-NUT of the tropics. TAHITI, SPANISH, or COUNTRY WALNUT. *Euphorbiaceæ*. Irregularly rounded to spheroidal nuts, from 1 to 2 inches in diameter, ranging in color from mottled gray to nearly black, and having a hard but brittle shell, about $\frac{1}{2}$ inch in thickness. Borne in fruits, 2 or 3 inches in diameter, containing about five nuts each. From the kernels of these nuts, which are considered edible only from certain species, and when half-ripe and roasted, there is obtained a valuable oil, known as country walnut oil, artists' oil, kekune (Ceylon), or kukui (Sandwich Islands) oil. Used medicinally, this oil has strong purgative properties; more largely, it is used in paints and varnishes, where it is said to have a very quick-drying and hardening effect. The cake which

remains after the oil has been expressed is used as a cattle-food and as a fertilizer. To a large extent, the nuts are strung on the fibers of a palm leaf and used as an illuminant by the natives where the species are grown.

The genus is native to the milder parts of the North Temperate, and the northern portion of the Tropical Zone of the Orient. The Office of Foreign Seed and Plant Introduction has introduced the wood-oil trees into the southern states and California, where their culture promises to become an important industry.

The following list includes the more important species and several of the common names by which the fruits are known: *A. Fordii*, Chinese wood-oil nut, tung yu; *A. molluccana* (*A. triloba*), candle-nut, Spanish walnut, Tahiti, or country walnut, kukui of Hawaii; *A. montana*, Mu-yu wood-oil.

Anacardium occidentale, **CASHEW**, **CACHEW**, **ACAJOU**, **CAJA**, **CAJOE**, **MONKEY-NUT**, *Anacardiaceae*. Kidney-shaped nuts, an inch or more long, by about $\frac{1}{2}$ inch wide and more than $\frac{1}{2}$ inch in thickness, with a double outer shell, between which is an oily, dark brownish fluid, very acrid and possessing extremely poisonous properties similar to those of poisonous ivy and sumac, to which the species is closely related. The outer shell is smooth and ivory-like in appear-

extent they are used when raw or boiled. The nuts are very rich in a valuable oil, useful in cooking and in the making of salads.

Areca Catechu, **BETEL-NUT**, **ARECA-NUT**, **PINANG**, *Palmaeceae*. Fig. 2539. The seed of an eastern tropical palm, which in size, general character and color much resembles the ordinary nutmeg. In form the "nuts" are not unlike the acorns of white oak, except that they are more rounded at the apex. To an enormous extent, betel-nuts are dipped in lime, wrapped in betel leaves (*Piper betle*) and chewed by the natives of the tropics, especially of India and the Philippines. The effect of betel-chewing is much the same as that of tobacco-chewing in this country. Fig. 367.

Attalea Cohune, **COHUNE-NUT**, **CAHOUN-NUT**, *Palmaeceae*. The oval or fusiform seeds of the cohune palm of Central America. Typical specimens measure from 2 to 2 $\frac{1}{2}$ inches in length, by about 1 $\frac{1}{2}$ inches in greatest diameter. Within the shell, which is fully $\frac{1}{2}$ inch in diameter and very hard, is a single elliptical kernel. Cohune-nut oil has long been used in the manufacture of soap and as an adulterant for coconut oil. At present "There is practically an unlimited demand for all of these (palm) oils in the European margarin trade, where they are now preferred to oleo oil and neutral lard as a hardening ingredient."—"Daily Consular and Trade Reports," June 27, 1914.

Attalea funifera, **COQUILLA-NUT**, *Palmaeceae*. Seeds of a rich brown color, 3 or 4 inches long, oval and of very hard texture. Used as a substitute for ivory in the manufacture of door-knobs, umbrella handles, buttons and various other commodities of the household. From a lofty South American palm. Fruits borne in large clusters.

Bassia latifolia (*Madhuca indica*), **ILLIPE**, or **ILLIPE-NUT**, *Sapotaceae*. The long-oval, smooth-surfaced, coffee-colored seed of a tree native to the East Indies. Typical seeds measure approximately 1 $\frac{1}{2}$ inches in length by $\frac{1}{2}$ inch in diameter. According to the "Daily Consular and Trade Reports," "Illipe-nuts are used to manufacture an edible oil similar to lard." This report further says: "There are two crops a year, one large and one small. The large crop is now (August 12) nearly finished and a new crop will come in from March to June, 1912."

Bertholletia excelsa, **BRAZILNUT**, **BUTTERNUT**, **NIGGER-TOE**, **CREAM-NUT**, **PARANUT**, **CASTANEA**, or **CASTANA** (corruption of "Castanha," Portuguese word for chestnut), **JUVIA-NUT**, *Myrtaceae*. The seeds of certain very large, uncultivated trees, common to great areas of the river-bottom sections of northern Brazil. Grown in a spherical or pear-shaped capsule of 2 $\frac{1}{2}$ or 3 inches in diameter, having a hard, woody, outer wall, within which are encased from eighteen to twenty-four of the nuts. The capsule is covered with a dark brown outer husk greatly resembling that of the walnut.

The nuts which are sharply triangular, measure from 1 $\frac{1}{2}$ to 2 or more inches in length, by $\frac{1}{2}$ to 1 inch in greatest diameter. They have a single, solid kernel, sweet and very good, which is protected by a somewhat rough, rigid but thin shell, to which it often closely adheres. Fig. 543.

Received into this country for consumption in enormous quantities during the months of spring and early summer, and held in storage until the following season.

Brosimum Alicastrum (*Piratinera Alicastrum*), **BREAD-NUT** of Jamaica, *Moraceae*.

The small roundish, yellow or brownish seeds, an inch or less in diameter, of a large tropical American tree. These seeds are borne singly or sometimes two in a thin paper-like, but stout shell, with smooth and somewhat granular surface. They are edible only after cooking or roasting.

Bunium Bulbocastanum, **LOUSY-NUT**, **EARTH-NUT**, **EARTH-CHESTNUT**, **RAW-NUT**, **KIPPER-NUT**, **PIG-NUT**, **AR-NUTS**, **YER-NUTS**, *Jur-Nuts*, *Umbelliferae*. Small nut-like tubers which form on the roots of plants of this species. They have a sweetish taste and are eaten by children, either raw or roasted. Rather too acid for adults unless roasted. From Western Europe.

Butyrospermum Parkii, **SHEA-NUT**, *Sapotaceae*. The shea-nut is the seed of an extensive African tree (butter tree) which according to Consul W. J. Yerby, "Daily Consular and Trade Reports," in Sierra Leone, British Africa, grows to a height of over 40 feet. "The nut," he says, "is of about the size and shape of a walnut, but is covered with a smooth skin resembling that of a Spanish chestnut, which can be pulled off in the same way when fresh. Inside this skin is a soft kernel of a light yellow color when fresh, and chocolate color when dry, which contains a large proportion of fatty material, that when extracted is called shea butter."

"The outside fleshy pulp, whose weight is approximately equal to that of the nut, rots away in time and splits, leaving the nut exposed. The natives hasten its removal by burying the freshly gathered fruit in a pit for some days. The nuts, divested of their outer covering (pulp), are dried, either by being placed in the sun for about twelve days or by heating in an earth oven. In this process the nut loses 30 to 40 per cent of its weight. The skin is removed and



2539. 1, Caryocar, husk above, nut below; 2, Teliairia; 3, Betel-nut, Areca; 4, Gevuina; 5, Pistacia; 6, Pili-nut, Canarium; 7, Semecarpus; 8, Trapa natans; 9, Trapa bispinosa. ($\times \frac{2}{3}$)

ance, rigid and tough but thin and easily cut. The kernels are firm, sweet, and very agreeable when roasted. The nuts are formed on the end of a fleshy pear-shaped pedicel. Figs. 33, 192, Vol. I.

Cashew-nuts do not appear in the market until after the poisonous properties have been entirely dispelled by roasting and the wholesome kernels have been separated from the shells. The species is native to the West Indies. It is now cultivated to a very large extent throughout the American tropics, both north and south of the equator.

Apios tuberosa, **GROUNDNUT**, **WILD BEAN**, *Leguminosae*. The numerous, dark brown, fleshy tubers from 1 to 2 inches in length, by 1 to 1 $\frac{1}{2}$ inches in diameter, and of somewhat irregular, oval or rounded form, which are borne on the rootstocks of an elegant twining perennial. Little use is made of these tubers, although they are said to have a rich nutty flavor when properly prepared. The species is native to lowlands of the eastern part of the United States, from Pennsylvania on the north, to Georgia on the south. Fig. 233.

Arachis hypogaea, **PEANUT**, **GOBER**, **PINDAR**, *Leguminosae*. **GROUNDNUT**, **GROUND PEA**, **MANILA-NUT**, **MONKEY-NUT**. Familiar straw-colored, oblong nuts, with thin fibrous, papery shells, rounded at the ends, and constricted at the middle, common at all fruit-stands. They are the seeds of a low-growing annual which pushes its pods under ground while they are maturing. Extensively cultivated in the southern part of the United States and elsewhere that seasons permit.

The constriction at the middle forms a partition between the two end chambers, each of which contains a single nutritious kernel. These are most commonly eaten when roasted, although to a large

the kernel remains. The shea-butter content of the deoiled kernel is 40 to 60 per cent of this weight of the kernel."

Regarding this butter, Yerby continues that "Purified shea-butter is edible and suitable for use in the preparation of artificial butter by chocolate manufacturers, etc., and the principal European demand will be for this purpose."

Shea-butter is used in the making of certain soaps but according to Yerby, "The high percentage of free fatty acids renders shea-butter unsuitable as a lubricant."

Calodendrum capensis (*Pallasia capensis*). CAPE CHESTNUT. WILD CHESTNUT. *Rutaceae*. The shining black, irregularly rounded, and somewhat wedge-shaped, seed of a subtropical tree of southern Africa, of about $\frac{3}{4}$ inch in length. These seeds have a stout but thin shell and a single farinaceous kernel, which resembles somewhat the texture of a chestnut. Cultivated mainly as an ornamental.

Canarium luzonicum. PILI (PEE-LEE)-NUT. PHILIPPINE-NUT. LUZON-NUT. JAVA ALMOND. PHILLO-NUT. *Burseraceae*. Fig. 2539. The smooth, hard-shelled, triangular seed of a tree native to the Philippine and other Pacific Islands of the far East, which has recently become very common in the American markets, sometimes separate, but more often in "mixed" nuts. The natural color of these nuts is a light brown, varying somewhat on different parts of the nut. As often seen in the market, it is of a uniform reddish color, given it by an artificial dye, which may readily be detected with a moistened finger.

These nuts are inclined to be slender, sometimes attaining a length of $2\frac{1}{2}$ inches and a middle diameter of but $\frac{3}{4}$ to $\frac{1}{2}$ of an inch, though sometimes they are short and blunt-pointed with about the same diameter. Typical specimens taper gracefully from near the middle into long, sharp-pointed ends. Inside the shells, which are exceedingly difficult to crack, are single kernels said to be of excellent quality in good specimens, but which as commonly appear in our markets are well below that of most other nuts.

The use to which pili-nuts are most commonly put is that of food, but it is said that to a more or less important extent, they are used in the manufacture of certain kinds of baby foods, emulsions, and the like.

Carya spp. HICKORY-NUTS. *Juglandaceae*. The seeds of one of the most important groups of American trees, representative species of which are indigenous to nearly every section of the central, eastern and southeastern parts of the United States. With the exception of a few which are very astringent, the nuts of all species are edible; some being among the choicest nuts of the market. Of the better known species, with the exception of the nuts of the pecan (*Carya Pecan*) and of the water-hickory, or bitter pecan (*C. aquatica*), hickory-nuts as a rule are inclined to be globular in form, sometimes of smooth surface, or with but faint ridges, but very often with sharp ridges and therefore distinctly angular. The color range of hickory-nuts includes almost white, creamy white, and light or dark brown, with gradations between. The shells vary in thickness from extreme paper-like thinness, characteristic of certain varieties of pecans, to extreme thickness and hardness, common with the mocker-, or bull-nut (*C. alba*). The kernels are formed in two distinct halves or cotyledons, separated from each other by a partition which may be thick, thin or papery, hard or curly, or a variation of any of these.

The following list includes the names of the more important species and their common names: *C. alba*, mocker-nut, bull-nut, big-bud hickory; *C. aquatica*, water-hickory, bitter pecan; *C. cordiformis*, bitter-nut, swamp-hickory; *C. glabra*, pig-nut; *C. laciniosa*, big shellbark, bottom shellbark, big shagbark, scalybark, king-nut, white walnut; *C. myristiciformis*, nutmeg-hickory; *C. ovalis*, small pignut, false shagbark; *C. ovata*, shagbark, little shagbark, little shellbark, little scalybark, white walnut, walnut, tuscatine; *C. Pecan*, pecan, Illinois nut. Figs. 823-831; 1836-7.

Caryocar spp. PERUVIAN ALMOND. *Caryocaraceae*. Fig. 2539. A nut, in many respects resembling the chestnut, from at least certain districts in Peru and western Brazil, which has probably not yet appeared in this country except in botanical collections. The kernel, which is about equal in size to that of the Brazil-nut, is borne singly in a bur resembling that of a rather small chestnut bur with very short spines, is somewhat kidney-shaped, and has a handsome rich brown color. In fineness of texture and in richness of flavor, this nut is said to excel any other nut of the tropics. It is most highly prized by the natives. Messrs. Bennett, Day & Company, importers in New York, now contemplate the making of inaugural shipments into this country during the coming season (1915-16).

There are said to be at least ten species of *Caryocar*. Of these, two from Guiana, both of which are called Guiana butternuts, are *Caryocar butyrosom*, pekea-nut, and *C. nuciferum*, souari or butter-nut.

Castanea spp. CHESTNUT. *Fagaceae*. Reddish brown, irregularly obovate, or obconic nuts, ranging in size from $\frac{1}{4}$ to 2 inches in greatest thickness, having thin papery shells, and being borne in stiff brown burs, slightly covered with stiff, short or long, single or compound, sharp spines. The fruits of an important genus, well known in many parts of the North Temperate Zone in both the Old World and the New. Kernels of the small American and Chinese chestnuts, and of the small chinquapins, are of excellent flavor; average European chestnuts are of fairly good flavor, by comparison, while the Japanese chestnuts are usually of very inferior quality, except when boiled, roasted, or otherwise prepared.

The names of the principal species bearing nuts of importance are as follows: *C. alniifolia*, creeping chestnut, southeastern United States; *C. crenata*, Japan chestnut, Japan; *C. dentata*, American chestnut, northeastern United States; *C. mollissima*, Chinese chestnut, China and Korea; *C. pumila*, chinquapin or dwarf chestnut, eastern and central United States; *C. sativa*, European, French, Spanish or Italian chestnut, Europe. Figs. 833-835; 911-917.

Castanospermum australe. MORETON BAY CHESTNUT. AUSTRALIAN CHESTNUT. *Leguminosae*. Seeds of an Australian plant, much the size of European chestnuts and having a chestnut-like flavor. The nuts which are somewhat rounded, spheroidal or flattened in form, are borne in pods an inch or more in thickness, and 6 or 8 inches in length. To some extent these nuts are roasted and eaten by the natives but are not altogether pleasant. To a limited extent this species has been introduced into southern California.

Cocos nucifera. COCONUT. *Palmaceae*. The well-known roundish or oval, nut-like seed, 3 or more inches in diameter, of a palm widely grown throughout all tropics. From the nuts, which are borne incased in very thick fibrous husks, is obtained the world's greatest food-supply. The flesh is wholesome either green or ripe, and either raw or cooked. The milk affords a very refreshing drink and the dried flesh, called "copra," is exported in enormous quantities. Coconut oil is one of the chief articles of export from the tropics. It is used in the manufacture of transparent and "marine" soaps. It is also largely used in pharmacy as a substitute for lard because of its less tendency to rancidity. Figs. 1011-1015.

Cola acuminata (*Cola*, or *Bichea*, *acuminata*). COLA. KOLA. BISSEY-BISSY. KORRA. KOLLA. GORRA. GURU. TEMPERANCE-NUT or OMBEENE-NUT. SOUDAN COFFEE. *Sterculiaceae*. The seeds of a large African tree, from which is obtained the stimulating drink, long used in the tropics and now very common as a summer drink in this country. The seeds are borne in long pods, containing from five to twelve seeds each. The cola-nut is described in the "United States Dispensatory," as being "irregular in form, reddish gray in color, from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches in length, flattened and rounded upon one surface, irregularly scooped or unfolded upon the other surface, the nut being apparently a cotyledon marked above with another cotyledon which it has embraced."

Corylus spp. HAZEL-NUT. FILBERT. COB-NUT. *Betulaceae*. The seeds of a plant usually of shrubby habit of growth, but with at least one exception (*C. Colurna*), developing into a large tree, which is well known throughout much of the North Temperate zone in both the Old World and the New. Form globular, short, flattened, or oblong-flattened, the oblong types usually being wedge-shaped at the apex, and all types having a large light colored scar covering the whole of the basal end, marking the point of attachment. In color the hazels somewhat resemble the chestnuts but are of a lighter and more yellowish brown. Within the shell, which is usually thin and easily cracked is a single, dry, tough, or firm kernel, usually of sweet and agreeable flavor. Figs. 1073-1075; 1788.

The following include the principal species which are now looked upon as being of cultural importance: *C. americana*, American hazel, northern United States and Canada; *C. californica*, California hazel, western United States; *C. rostrata*, beaked hazel, northern United States and Canada; *C. avellana*, European hazel, hazel-nut, nuttaz tree, bread-nut, filbert, filberd, filberd, philbert or cob-nut, southern Europe; *C. Colurna*, Constantinople hazel, Asia Minor, China; *C. maxima*; (*C. tubulosa*), Lambert's filbert, Europe.

Crecentia Cujete. JICARA-NUT. *Bignoniaceae*. According to Fuller, in the "Nut Culturist," the name jicara-nut is applied locally in some of the Central American states, to the fruit of the evergreen calabash tree. Fruits vary greatly in both size and form, some being small and others from 18 to 20 inches in diameter. Some are symmetrical while others are of quite irregular form, but typical specimens are globular. They have a hard outer shell and an inner pulp which supports the seeds. The empty shells are used as drinking vessels and because of their ability to resist fire are considerably used as kettles for culinary purposes. Fig. 1106.

Cyperus esculentus. CHUFA. EARTH ALMOND. RUSH-NUT. EDIBLE RUSH. *Cyperaceae*. The small edible tubers of a sedge plant which, to a considerable extent, are grown in warm climates as a food for swine. Native to southern Europe. For fuller account, see *Chufa* and *Cyperus esculentus* in Volume II. Figs. 959; 1194.

Durio zibethinus. DURIAN-NUT. *Bombacaceae*. The seed of a large forest tree of the East Indies and the Malay Peninsula, resembling the American elm somewhat in general appearance. According to Lindley, in "The Treasury of Botany," "The fruit varies in shape, being either globular or oval, and measures as much as 10 inches in length; it has a thick hard rind, entirely covered with very strong sharp prickles, and is divided into five cells, each of which contains from one to four seeds rather larger than pigeon's eggs and completely enveloped in a firm luscious-looking, cream-colored pulp, which is the edible portion of the fruit."

Lyons, in "Plant Names, Scientific and Popular," says that the fruit is "delicious in flavor, but of intolerable odor."

The seeds are roasted and eaten as are chestnuts. Numerous efforts have been made to establish this plant in Florida but thus far without success, due partly to the difficulty in shipping the tender plants, and also because of the inability of the species to endure the Florida climate. See also *Durio*, page 1081; Fig. 1366.

Elais guineensis. PALM-NUT. *Palmaceae*. The small irregularly formed seeds of a tropical African palm, famous for its production of palm-oil or palm-butter, as it is also called, which is largely used in the manufacture of soap and to some extent as a coloring-matter for oleomargarine. Nuts measure from 1 to $1\frac{1}{2}$ inches in length by about $\frac{3}{4}$ inch in greatest thickness. They are very hard, have a thick ivory-like flesh and a small cavity in the center. The nuts are encased in a fibrous covering which contains the oil. According to the Kew Bulletin, "Three varieties of nut trees are distinguished, having orange, red, and black nuts respectively, the first having the finest oil but small kernels, the others less oil but large nuts." The oil is extracted by boiling the nuts.

Lindley, in the "Treasury of Botany," says that of the shells, which are very hard and capable of taking a high polish, the negroes make rings and other ornamental articles.

Euryale ferox. FOX-NUT. GORGON- (Greek meaning terrible) NUT. *Nymphaeaceae*. The spiny-covered edible seeds of a handsome, floating water-plant of eastern India. Believed by the Hindoo physicians to possess certain medicinal properties. It has long been cultivated in China and now to a considerable extent is common in the milder portions of the temperate United States.

Fagus grandifolia. AMERICAN BEECH-NUT. *Fagaceae*. Small triangular seeds which in form and general appearance greatly resemble overgrown seeds of buckwheat. In character of shell and in flavor of kernel, beech-nuts greatly resemble the chestnut. Owing to the tediousness of separating the kernel from the shell, these nuts are not so largely harvested as undoubtedly would otherwise be the case. Figs. 1471-5.

From the seeds of the European beech (*Fagus sylvatica*), which also are edible, there is obtained a valuable oil, used as food and in the manufacture of soaps and as an illuminant.

Fusanus acuminatus (*Mida acuminata*). QUANDONG- or QUANDANG-NUT. *Santalaceae*. The spherical, yellowish, rather thick-shelled seeds of an edible Australian tree-fruit called the "native peach." Of about the size of marbles. Surface covered with numerous small but deep pits. Kernel single. The fruit is quite edible and is locally used as a preserve.

Gevuina Avellana. CHILIAN-NUT. CHILE HAZEL. AVELLANO. *Proteaceae*. Fig. 2539. Small seeds of an evergreen tree from Chile. Globular in form, with smooth, tough shell and a kernel much like that of a hazel in both appearance and flavor. Seeds borne within a coral-red fruit. Cultivated to some extent in California.

Ginkgo biloba. GINKGO-NUT. *Ginkgoaceae*. The oval, creamy white seeds of the ginkgo or maidenhair tree from China and Japan, which, to a considerable extent, is a familiar ornamental tree in temperate America. The nuts measure about $\frac{1}{2}$ inch in length, by $\frac{3}{8}$ inch in width, by $\frac{1}{2}$ inch in thickness. They have smooth and thin, but stout shells, within which are single green-colored kernels of rather sweetish flavor. When roasted, the kernels are said to be very palatable and are highly prized by the Chinese. At best, however, ginkgo nuts are inferior to most of the nuts on the market and are therefore not popular with the American people. Figs. 1640-42.

The fruit of the ginkgo considerably resembles that of the native persimmon in color, size and character, but differs from it in that the ginkgo flesh is of a disagreeable odor.

Guilandina Bonduc. NICKER. NICKAR. BONDOC-NUT or BEZOA-NUT. *Leguminosae*. The blue-gray, irregularly rounded, smooth-surfaced, beautiful seeds of a climbing legume of the tropics. The seeds are somewhat less than an inch in greatest diameter and have very hard shells. They are used as beads and to some extent for medicinal purposes.

The species has a very wide distribution caused by the seeds being transported by ocean currents; their imperviousness enabling them to be carried by waves for an indefinite length of time.

Hybrid nuts of the family Juglandaceae. Such crosses as the pecan with some other species of hickory; the Persian walnut with some species of black walnut; the eastern American black walnut with one or the other of the California black walnuts are not infrequently met with in nature. The trees resulting from such crosses are very un-uniform in their character and rate of growth, some being extremely slow to develop and others very rapid, while others range between these extremes. A number of the pecan and hickory crosses have attracted considerable attention, because of their vigor of growth and production, but none of commercial importance has yet come to public attention. Such crosses are known as "hicans." The more rapid-growing of the walnut hybrids are much in use as stocks for clions of the Persian walnut of California. Ordinarily the walnut hybrids bear very light crops and the nuts are of little value. See *Juglans*.

Crosses between the eastern and either of the California black walnuts are called Royal and those between any of the black and the Persian walnuts are called Paradox.

Hyphæne crinita. HYPHÆNE-NUT. DOOM-NUT. DOOM-NUT. *Palmyraceae*. The seeds of a slow-growing African palm. From specimens received at the Office of Seed and Plant Introduction, Department of Agriculture, it appears that there are at least two quite different types of nuts appearing under this name, both of which have been considerably employed as substitutes for the more expensive ivory-nuts (*Phytolophus Seemannii*) of South America. Nuts of one of these types are of a light yellowish outer color, irregularly jug-shaped, approximately 2 inches thick by $2\frac{1}{2}$ inches long, and covered with a smooth-surfaced fibrous husk $\frac{1}{2}$ inch thick. Nuts of the other type are somewhat larger, less regular in form, and of a buff-color, but having much the same sort of outer husk and inner characters. The thick wall of pure white, hard flesh within the woody shell of each is used in the making of buttons, but reports from American and German manufacturers are to the effect that buttons of this material are much inclined to warp and shrivel.

Inocarpus edulis. TAHITIAN, SOUTH SEA, FLI, POLYNESIAN, or OTAHITE CHESTNUT. *Leguminosae*. The seed of a tree native to the South Sea and neighboring islands. Borne singly in flat, fibrous pods, having a smooth outer surface. They are thin and somewhat wedge-shaped. Typical specimens measure approximately 2 by $1\frac{3}{4}$ by $\frac{1}{4}$ inches. When prepared by roasting or boiling, these nuts are said to have a chestnut-like flavor.

Jatropha Curcas. PHYSIC-NUT. FRENCH PHYSIC-NUT. BAIKADON-NUT. PRISING-NUT. *Euphorbiaceae*. Small, oblong, rounded seeds of about $\frac{3}{4}$ inch long, $\frac{1}{4}$ inch wide, by $\frac{3}{8}$ inch thick, of a bluish color, and having a thin strong shell, of a shrubby, tropical American tree. From the kernel, which is white and solid, there is obtained a strong purgative oil (curcas oil) which is also used for

illuminating purposes. To some extent, this tree is grown in the warmer parts of the United States, but probably only as an ornamental.

Jubæa spectabilis. COQUITA-NUT. JUBA-NUT. COKER-NUT. DWARF COCONUT. MONKEY'S COCONUTS. *Palmyraceae*. Small globular nuts 1 inch or less in diameter, having a smooth-surfaced, rather thick and very hard shell, within which is a flesh and open center much like that of the common coconut. The seeds of the wine palm of Chile. Consul Clement S. Edwards, in the "Daily Consular and Trade Reports," says: "Coquito-nuts (little coconuts) are found in this region (Mexico), but the entire amount gathered is taken by the local soap manufactures, the managers of which are constantly complaining that they cannot procure sufficient material from this (Acapulco) neighborhood for their needs."

Juglans spp. WALNUT. BUTTERNUT. *Juglandaceae*. The nuts of a very important group of trees, representative species of which are found in many parts of the world, usually in the temperate zones. To this group, which is closely related to that of the hickories, belongs the well-known Persian, or more commonly called "English" walnut, the California product of which alone is annually worth more than double that of any other nut now grown in this country.

As with nuts of the hickory species, the walnuts vary greatly in size, form, thickness of shell, and, except in abnormal cases, which



2540. Great nut of a *lecythis*, or monkey-pot. ($\times \frac{1}{4}$)

are very rare, the kernels are formed in two distinct halves, or cotyledons. The kernels of both are rich in valuable oils, which doubtless eventually will come into general use in the making of salads and for other purposes of cooking, but which are now used mainly in arts and paints, and as illuminants or lubricants. In color, the walnuts range from the light yellow or orange of the Persian walnut to the dark brown or black, of the black walnut. With the exception of the butternut, or the "white walnut," as it is quite largely known, which is fairly cylindrical, and about one-third longer than thick, and which has a rough sharp-pointed surface, the several species of American walnuts and a number of the foreign walnuts, are spherical or spheroidal in general form.

The usual difficulty with which the kernels are separated from the thick shells of the common butternut and black walnuts has prevented the nuts of either species from becoming generally popular on the market. Horticulturally speaking, there are now no recognized varieties of butternuts and but very few of black walnuts.

The list which follows includes practically all of the better known species of walnuts with their common names. For fuller accounts of each species, see Volume III: *J. australis*, Australian black walnut; *J. bolivianensis*, Bolivian black walnut; *J. californica*, California black walnut (southern type); *J. Sieboldiana* var. *cordiformis*, Japanese walnut, heart-nut; *J. cinerea*, butternut, white walnut; *J. Hindii*, California black walnut (northern type); *J. major*, Arizona black walnut; *J. mandshurica*, Japanese walnut, Manchurian walnut; *J. nigra*, American black or eastern black walnut; *J. regia*, Persian, English, Royal, Italian, Madeira, European, French, Chile, Caucasian, Manchurian, Circassian walnut; *J. rupestris*, Texas walnut, New Mexico walnut; *J. Sieboldiana*, Japanese walnut. Figs. 2011-2019.

Lecythis spp. SAPUCAIA- or SAPUCAYA-NUT. PARADISE-NUT. MONKEY-POT-NUT. *Myrtaceae*. Fig. 2540. An oblong, irregularly shaped, though somewhat triangular nut, with irregular, longitudinal grooves over its whole surface, and having a rather thick, cork-like shell, which may be easily cut, and a single solid kernel, which considerably resembles that of the Brazil-nut (*Bertholletia excelsa*) to which it is closely related, but than which it is of much finer texture and of more delicate, pleasing flavor.

A quart or more of these nuts are borne in a heavily walled capsule of urn-shape, measuring from 6 to 8 inches in diameter at the middle, in the top of which is a perfectly fitting lid, from 2 to

4 inches across, which is said to be automatically thrown off with a sharp sound, by the contraction of the capsule at maturity. As the weight, which at that time must be from five to eight pounds, has caused the capsule to assume an inverted position, the nuts are scattered upon the ground. The scramble which follows of the monkeys and other small animals of the forest, to be first upon the scene for the nuts, has given this capsule the name of "monkey-pot," and the group of closely related species having similar capsules the name of the "monkey-pot group."

These species are native to much the same districts of South America as is the Brazil-nut.

Litchi chinensis (*Nephelium Litchi*). LITCHI. LITSCHI. LIQU. LEECHIE. LITCHEE. CHINESE-NUT. CHINESE HAZEL. DAWA-NUT. *Sapindaceae*. A brown-colored, warty appearing fruit, in size and form resembling that of a strawberry, with an outer thin, papery shell, within which is a central smooth hard-shelled seed, surrounded by a brownish pulp of a delicious, subacid flavor. The fruit of a low-growing, tender tree, native to China. Under test for some years in Florida and in California.

Macadamia ternifolia. QUEENSLAND-NUT. AUSTRALIAN HAZEL-NUT. AUSTRALIAN-NUT. *Proteaceae*. A globular smooth-surfaced nut, of a light, yellowish brown color, 1 inch or less in diameter, with a very hard, rather thick shell, within which is a single kernel, resembling in form that of a hazel, to which it is greatly superior in richness and flavor. The fruit of an evergreen tree from Australia. There are a few trees of this species in California. Fig. 2241.

Manketti nuts. Mentioned in the "Daily Consular and Trade Reports," October 23, 1912, as having comprised a trial shipment of 22,500 pounds, which had recently been made to Europe from German southwest Africa, with a view to testing their commercial value. The nuts were said to have been gathered from wild trees in the neighborhood of Tsumed. According to this report, "It is said that the natives and bushmen eat the fruit without any ill effects." Efforts to find reference to the name "manketti" in botanical works have thus far met with failure. It is suspected, however, that the article from which this citation was taken had reference to the palm-nut, *Elais guineensis*.

Mauritia flexuosa. MIRITI. (Me-rish-i-e), IRA. (I-te) PALM, or BURITI-NUT. *Palmaceae*. The wine-colored seed, with flattened ends, of a lofty tropical American palm. This seed, which is about equal in size to that of the Persian walnut, is covered with very regular, close-fitting scales, underneath which is a tough shell, enclosing a single ivory-like, globular, and farinaceous kernel about 1 inch in diameter. Much used as a food by the natives.

Moringa oleifera (*M. pterygosperma*). BEN-NUT. *Moringaceae*. The seeds of a species of small tree native to tropical Asia, from which is expressed the ben-nut oil, largely used in the manufacture of perfumery. Seeds small, papery white, winged, triangular and resembling buckwheat grains in form. Figs. 2387, 2388.

Nelumbo lutea. NELUMBO. NELUMBUM. AMERICAN LOTUS. WATER CHINQUAPIN. WATER-NUT. RATTLE-NUT. *Nymphaeaceae*. The small dark blue, nearly spherical seed of the American lotus or great water lily. About $\frac{1}{2}$ inch in diameter, with smooth surface and a strong shell, within which is an edible kernel. *Nelumbo nucifera* is eaten in China as a nut.

Ophiocaryon paradoxum. SNAKE-NUT of Guiana. *Sabiaceae*. Described by Fuller, viz.: "A large, roundish fruit, about the size of a black walnut, the product of a large tree of the soapberry family, native of British Guiana. This nut takes its name of 'snake-nut' from the peculiar form of the embryo of the seed, which is curled up spirally."

"The Indians, thinking there must be some virtue in form, use these nuts as an antidote for snake-bites, although so far as known to science they do not possess any medicinal properties."

Panax trifolium. GROUND-NUT. *Araliaceae*. The globose, pungent-tasting nut of the dwarf ginseng of the northern states. Of about the size of a radish.

Parkia africana. NITTA- or NUTTA-NUT. *Leguminosae*. Edible seeds, borne within the long clustered pods of the African locust tree. The pods, containing a sweetish farinaceous pulp within which the seeds are imbedded, are eaten entire, as is the carob or St. John's bread.

Pasania cornea. EDIBLE ACORN. *Fagaceae*. The seed of an evergreen tree of China, closely related to the oak. Now being tried out in this country by the Office of Foreign Seed and Plant Introduction, which says regarding it: "The nuts are as thick-walled as hickory-nuts; the kernels are white and of characteristic shape, and have a sweet, very agreeable flavor. In China, they are sold on the markets as are chestnuts here."

The nuts are very broad in proportion to their length, presenting a flattish appearance.

Pasania cuspidata. EDIBLE ACORN. *Fagaceae*. Described by the Office of Foreign Seed and Plant Introduction, by which it is being tested in this country, with stock from a Yokohama nursery, as being "A small acorn, edible and sweet, when ripe or after frost, boiled or roasted." From Formosa, Korea, and milder parts of China.

Phytelphas Seemannii. IVORY-, TAGUA-, TAQUA-, or VEGETABLE IVORY-NUT. NEGRO'S-HEAD. *Palmaceae*. The rounded, somewhat wedge-shaped seeds, or nuts of a low-growing reclining Central American palm, which in size and form greatly resemble very large chestnuts. Each nut is covered with a smooth, thin but strong shell of a light yellowish color, mottled with brown. The flesh is solid, pure white or creamy white, and capable of taking a very high polish. When cut or turned, they are used as a substitute for ivory in the manufacture of buttons, toys, and various kinds of ornamental work.

These seeds are borne in large compound chambers compactly joined together into heads a foot or more in diameter and covered with a sharp thorny surface, of a gray color. Each chamber contains from four to nine of the nuts, each of which is encased within its own shell.

The manufacturing of useful articles from ivory-nuts for the household is a very important industry in Germany, Hamburg being one of the chief centers.

Pinus spp. PINE-NUT. INDIAN-NUT. PINON (PIN-YON). PIGNOLIA. PIGNON. *Pinaceae*. The seeds of a considerable number of both foreign and American pines having rich, edible kernels which form an important article of food in many sections where the species are indigenous. Probably the largest of edible pine seeds are those of the Araucarian pines of Chile, of which there are several species. Not infrequently, seeds of these pines exceed 2 inches in length.

Of commonest appearance in our American markets are the seeds of the stone pine, *P. Pinex*, of southern Europe, which are sold under the names of "pignolis," or "pine-nuts," and to an increasing extent under the Mexican name "piñon," which originally was applied only to the seeds of certain American pines of the Southwest. As marketed, these nuts usually appear without the shells, in which condition they greatly resemble puffed rice.

Although some 12 or 15 species of American pines yield edible nuts, their product is seldom seen in any but the western markets, as it is largely consumed locally by the Indians of the Southwest and the Mexicans. These nuts are known as "piñons," "pine-nuts," and "Indian-nuts."

While none of the seeds of the American group are large, they vary greatly in size, form, and color. In flavor of kernel they are much alike. Usually they are irregular in form, longer than thick, sometimes slender but generally of about the same diameter each way. They range from $\frac{1}{8}$ to $\frac{1}{4}$ inch in length. In color they run from a light yellow, on one side at the basal end, to a brownish black at the opposite end, with a coffee-brown probably predominating.

The following list includes the names of the more important pines which bear edible nuts: *Araucaria brasiliana*, Chile; *A. imbricata*, monkey puzzle, Chile; *Pinus albicaulis*, white bark pine, western United States; *P. cembroides*, Arizona piñon, southwestern United States; *P. Coulteri*, big-cone or Coulter's pine, western United States; *P. edulis*, piñon, southwestern United States; *P. Jeffreyi*, black pine, western United States; *P. Lambertiana*, sugar, shade, gigantic, or purple-coned pine, western United States; *P. monophylla*, single-leaf, or gray pine, western United States; *P. monticola*, mountain, finger-cone, or western white pine, western United States; *P. Parryana*, Parry's pine, or Mexican piñon, western Mexico; *P. Pinex*, stone pine, seeds called pine-nuts, pignolis, piñon, and pignon, southern Europe; *P. Sabiniiana*, digger or gray-leaf pine, western United States; *P. Torrejana*, Torrey, Soledad, or Delmar pine, southern California.

Pistacia vera. PISTACHE. PISTACHIO-NUT. GREEN ALMOND. FISTICHE. *Anacardiaceae*. Fig. 2539. A small nut about $\frac{1}{2}$ inch long and slightly more than half as thick, which usually appears in the market with its thin, brittle shell partially split open, and with its kernel having a distinct salty taste. This is the seed of a Syrian tree which has been split open while maturing and which later has been roasted and salted. Typical kernels are of a distinct greenish color throughout and have a mild agreeable flavor. When ground, these kernels are used to a very large extent to afford the color and flavor of certain confections, especially ice-cream.

Trees of *P. vera* are fairly common in nut orchards of interior southern California, New Mexico and western Texas.

Prunus Amygdalus. ALMOND. *Rosaceae*. Familiar products in all nut markets. To a considerable extent the form of the almond resembles that of an oyster-shell, although there is a very great variation in the length and width of the nuts of different varieties. Some are long and narrow, others short and thick, while still others range between. The shells of some are very thin, breaking readily when crushed together with one hand. These are called paper-shells. Others, called hardshells, require a sharp blow with a hammer for cracking. Almonds ranging between the hard and the paper-shells are called soft-shells. As they appear in the markets, almonds usually are of a uniform light yellowish color, which has been given them by artificial bleaching. The normal color is of a rather dull yellow, or as in the case of the hardshells, a brown closely resembling that of a peach pit.

At present the almond is the third most important nut crop in the United States, the first being that of the Persian or English walnut, and the second, the pecan. The entire output from this country is produced from beyond the Rocky Mountains, mainly from the Sacramento Valley of California.

Pterocarya fraxinifolia. WINGED WALNUT. CAUCASIAN WALNUT. *Juglandaceae*. Small, angular, winged seeds, having hard shells, of a tree, native to western Asia. Of no economic importance. This and several other species of *Pterocarya* are employed to a considerable extent as ornamentals in the milder portions of temperate America.

Pycnocoma macrophylla. BOMAH-NUT. BOMA. BOME. *Euphorbiaceae*. The seed of an African shrub used in tanning, and which yields a fixed oil.

Pyralaria pubera. BUFFALO-NUT. OIL-NUT. ELK-NUT. *Santalaceae*. The small seed of a pear-shaped drupe, which is the fruit of an eastern American shrub native from Pennsylvania to Georgia. About 1 inch long, subglobose, thin-shelled, and containing a kernel rich in oil and of a strong acid flavor. Without economic value.

Sapium sechiferum (*Stillingia sebifera*). TALLOW-NUT. CHINESE TALLOW-NUT. *Euphorbiaceae*. The whitish colored fruits,

about $\frac{1}{4}$ inch in diameter, of a Chinese tree. Borne singly in three-chambered capsules. The nuts consist of relatively large, brown seeds, having hard shells with a thick coating of a fatty substance, which is used in various ways as a substitute for animal tallow. From China and Japan.

Semecarpus Anacardium. MARKING-NUT. MARANY-NUT. MARSH-NUT. ORIENTAL CASHEW. *Anacardiaceae*. Fig. 2539. The black, lobe-like, somewhat contorted seed of about 1 inch in length, by $\frac{1}{4}$ inch wide, and $\frac{3}{8}$ inch thick, of an evergreen tree native to the warmer parts of Asia. A very useful ink is made by mixing lime with the green juice of these seeds. It is said that to a considerable extent the natives roast and eat these seeds.

Unless roasted, these nuts should be handled with great precaution, as in the raw condition they possess extremely poisonous properties similar to those of the American poisons, ivy and sumac, and the cashew, to which it is closely related.

Staphylea trifolia. AMERICAN BLADDER-NUT. *Staphyleaceae*. The fruit of a shrub common in eastern and northern United States. Triangular in form, measuring from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches in length by about $\frac{3}{4}$ inch in width, covered with a thin papery shell of a reddish brown or buckwheat color, and having a rather long, sharp point at the apex. Fruit three-celled, each cell containing several (usually three) small, smooth and very hard shining seeds. Fruits remain on shrubs during winter. Of use only as ornamentals.

Strychnos potatorum. CLEARING-NUT. INDIAN GUM-NUTS. WATER-FILTER-NUT. *Loganiaceae*. The seed of an oriental tree, which is largely employed by the natives because of its power of causing impurities in water to settle to the bottom. Receptacles in which water is to be placed are vigorously rubbed with one of the nuts; later the water is poured in and the impurities quickly unite together at the bottom, leaving the water perfectly clear.

Telfairia pedata. TADEBUI. *Cucurbitaceae*. Fig. 2539. The thin, broad seed, in form resembling a longitudinal section of a shortened tulip bulb, of a rapidly growing tropical climber from Africa. Typical specimens measure about $1\frac{1}{4}$ inches in length, by slightly more in width, and about $\frac{3}{8}$ inch in thickness. They are covered with a tough fibrous seedcoat of a straw-color. Within this is a solid palatable kernel, resembling the Brazil-nut greatly in texture and somewhat in flavor.

Terminalia Catappa. TROPICAL ALMOND. DEMARARA ALMOND. MALABAR ALMOND. MYROBOLAN-NUT. TAYOLA-NUT. *Combretaceae*. The oblong, broad-oval, smooth-surfaced seed, with a sharp ridge marking the sutures on the two sides, of a very tall deciduous tree of southern Asia. The long and very slender kernel, encased within the thick porous husk of this seed is said to have an almond-like flavor.

Theobroma Cacao. CHOCOLATE-NUT. CHOCOLATE-BEAN. *Sterculiaceae*. The dark reddish brown, bean-like seeds of a small genus of tropical America which affords the cacao butter of commerce. These seeds are about $\frac{1}{2}$ inch long, by $\frac{1}{2}$ inch wide and $\frac{3}{8}$ inch thick.

Thespesia populnea. PORTIA-NUT. *Malvaceae*. The small obovoid brown seeds of a tree, native to tropical parts of the Old World. Seeds have a netted veined surface, yellowish brown pubescence on inner edges, especially at apex, and a thin but stout shell. Portia-nuts yield an oil used as an illuminant.

Torreya nucifera. TORREY-NUT. FALSE NUTMEG. *Taxaceae*. The small brown-colored, somewhat mottled, thin-shelled, oblong-oval seeds, of a good-sized coniferous tree native to Japan. Eaten either raw or roasted.

Trapa natans. WATER CHESTNUT. WATER CALTROPES. WATER-NUT. HORN CHESTNUT. JESUIT CHESTNUT. *Trapaceae*. Fig. 2539. The seed of a water-plant of southern Europe, much sought after by the natives for their agreeable kernels which become inedible with the hardening of the shell. In form, these nuts are very irregular, measuring from 2 to 3 inches between the tips of the short stout horns, and about 1 inch in depth through the irregularly shaped head of the nut. These nuts are of a slatish brown color and their surface is quite smooth.

Trapa bispinosa. SINGHARA-NUT. *Trapaceae*. Fig. 2539. Southern Asia and northern Africa. According to Watt, in the "Commercial Products of India," "This aquatic plant has been grown in India from the most ancient times. . . . In certain parts of the country the kernels are ground down and employed for making the colored powder (gulal) used during the Holi festival." They are also used medicinally and as a staple article of food.

In growing, the nuts "mature under water" and are "gathered in November and December." In certain sections it is "extensively cultivated, e. g., in Kashmir, the United and Central Provinces, etc." "The kernel abounds in starch, and is eaten either raw or cooked, especially by the Hindus. It may be boiled whole, after soaking a night in water, roughly broken up and made into a sort of porridge, or ground to meal and into chapattis."

THE COMMON NAMES OF NUTS WITH THEIR TECHNICAL EQUIVALENTS, UNDER WHICH THE NUTS ARE DESCRIBED.

Acajou.....	<i>Anacardium occidentale</i> .
Acorn, edible.....	<i>Passania cornea</i> .
Acorn, edible.....	<i>Passania cuspidata</i> .
Almond (of commerce).....	<i>Prunus Amygdalus</i> .
Almond, Demarara.....	<i>Terminalia Catappa</i> .
Almond, earth.....	<i>Cyperus esculentus</i> .
Almond, green.....	<i>Pistacia vera</i> .
Almond, Java.....	<i>Cannarium luzonicum</i> .
Almond, Malabar.....	<i>Terminalia Catappa</i> .
Almond, Peruvian.....	<i>Caryocar sp.</i>

Almond, tropical.....	<i>Terminalia Catappa</i> .
Areca-nut.....	<i>Areca Catechu</i> .
Ar-nut.....	<i>Bunium Bulbocastanum</i> .
Australian-nut.....	<i>Macadamia ternifolia</i> .
Barbados-nut.....	<i>Jatropha Curcas</i> .
Beazor-nut.....	<i>Gulandina Bonduc</i> .
Beech-nut.....	<i>Fagus grandiflora</i> .
Ben-nut.....	<i>Moringa oleifera</i> .
Betel-nut.....	<i>Areca Catechu</i> .
Bissy-bissy-nut.....	<i>Cola acuminata</i> .
Bitter-nut.....	<i>Carya cordiformis</i> .
Bladder-nut, American.....	<i>Staphylea trifolia</i> .
Boma-nut.....	<i>Pycnocoma macrophylla</i> .
Bomah-nut.....	<i>Pycnocoma macrophylla</i> .
Bome-nut.....	<i>Pycnocoma macrophylla</i> .
Bonduc-nut.....	<i>Gulandina Bonduc</i> .
Brazil-nut.....	<i>Bertholletia excelsa</i> .
Bread-nut.....	<i>Brosimum Alicastrum</i> .
Bread-nut.....	<i>Corylus Avellana</i> .
Buffalo-nut.....	<i>Pyralia oleifera</i> .
Buriti-nut.....	<i>Mauritia flexuosa</i> .
Butternut.....	<i>Bertholletia excelsa</i> .
Butternut.....	<i>Caryocar nuciferum</i> .
Butternut.....	<i>Juglans cinerea</i> .
Butternut, Guiana.....	<i>Caryocar sp.</i>
Butter tree.....	<i>Butyrospermum Parkii</i> .
Cachew-nut.....	<i>Anacardium occidentale</i> .
Cahoun-nut.....	<i>Attalea Cohune</i> .
Caja-nut.....	<i>Anacardium occidentale</i> .
Cajou-nut.....	<i>Anacardium occidentale</i> .
Candle-nut.....	<i>Aleurites molluccana</i> .
Cashew-nut.....	<i>Anacardium occidentale</i> .
Cashew, oriental.....	<i>Semecarpus Anacardium</i> .
Castana.....	<i>Bertholletia excelsa</i> .
Castanea.....	<i>Bertholletia excelsa</i> .
Chestnut, American Sweet.....	<i>Castanea dentata</i> .
Chestnut, Australian.....	<i>Castanospermum australe</i> .
Chestnut, Cape.....	<i>Calodendrum capensis</i> .
Chestnut, Chinese.....	<i>Castanea mollissima</i> .
Chestnut, creeping.....	<i>Castanea alnifolia</i> .
Chestnut, dwarf.....	<i>Castanea pumila</i> .
Chestnut, earth.....	<i>Bunium Bulbocastanum</i> .
Chestnut, European.....	<i>Castanea sativa</i> .
Chestnut, Fiji.....	<i>Inocarpus edulis</i> .
Chestnut, French.....	<i>Castanea sativa</i> .
Chestnut, horn.....	<i>Trapa natans</i> .
Chestnut, horse.....	<i>Æsculus Hippocastanum</i> .
Chestnut, Italian.....	<i>Castanea sativa</i> .
Chestnut, Japanese.....	<i>Castanea crenata</i> .
Chestnut, Jesuit.....	<i>Trapa natans</i> .
Chestnut, Moreton Bay.....	<i>Castanospermum australe</i> .
Chestnut, Otaheite.....	<i>Inocarpus edulis</i> .
Chestnut, Polynesian.....	<i>Inocarpus edulis</i> .
Chestnut, Spanish.....	<i>Castanea sativa</i> .
Chestnut, South Sea.....	<i>Inocarpus edulis</i> .
Chestnut, Tahitian.....	<i>Inocarpus edulis</i> .
Chestnut, water.....	<i>Trapa natans</i> .
Chestnut, wild.....	<i>Calodendrum capensis</i> .
Chilean-nut.....	<i>Gevuina Avellana</i> .
Chinese-nut.....	<i>Litchi chinensis</i> .
Chinese tallow-nut.....	<i>Sapium sebiferum</i> .
Chinquapin.....	<i>Castanea pumila</i> .
Chocolate-nut.....	<i>Theobroma Cacao</i> .
Chufa.....	<i>Cyperus esculentus</i> .
Clearing-nut.....	<i>Strychnos potatorum</i> .
Cob-nut.....	<i>Corylus Avellana</i> .
Coconut.....	<i>Cocos nucifera</i> .
Coconut, dwarf.....	<i>Jubaa spectabilis</i> .
Coconut, monkey's.....	<i>Jubaa spectabilis</i> .
Cohune-nut.....	<i>Attalea Cohune</i> .
Coker-nut.....	<i>Jubaa spectabilis</i> .
Cola-nut.....	<i>Cola acuminata</i> .
Coquilla-nut.....	<i>Attalea funifera</i> .
Coquita-nut.....	<i>Jubaa spectabilis</i> .
Cream-nut.....	<i>Bertholletia excelsa</i> .
Dawa-nut.....	<i>Nephelium Litchi</i> .
Doom-nut.....	<i>Hyphane crinita</i> .
Doom-nut.....	<i>Hyphane crinita</i> .
Durian-nut.....	<i>Durio zibethinus</i> .
Earth-nut.....	<i>Bunium Bulbocastanum</i> .
Edible rush.....	<i>Cyperus esculentus</i> .
Elk-nut.....	<i>Pyralia oleifera</i> .
Filberd.....	<i>Corylus Avellana</i> .
Filberd.....	<i>Corylus Avellana</i> .
Filbert.....	<i>Corylus Avellana</i> .
Filbert, Lambert's.....	<i>Corylus maxima</i> .
Fistich-nut.....	<i>Pistacia vera</i> .
Fox-nut.....	<i>Euryale ferox</i> .
French physis-nut.....	<i>Jatropha Curcas</i> .
Ginkgo-nut.....	<i>Ginkgo biloba</i> .
Goober.....	<i>Arachis hypogaea</i> .
Goora-nut.....	<i>Cola acuminata</i> .
Gorgon-nut.....	<i>Euryale ferox</i> .
Gorra-nut.....	<i>Cola acuminata</i> .
Groundnut.....	<i>Apios tuberosa</i> .
Groundnut.....	<i>Arachis hypogaea</i> .
Groundnut.....	<i>Peanar trifolium</i> .
Ground nut.....	<i>Arachis hypogaea</i> .
Guru-nut.....	<i>Cola acuminata</i> .
Hale-nut.....	<i>Corylus Avellana</i> .
Hawk-nut.....	<i>Bunium Bulbocastanum</i> .

Hazel, American.....	<i>Corylus americana.</i>	Pinon.....	<i>Pinus sp.</i>
Hazel, Australian.....	<i>Macadamia ternifolia.</i>	Pistache.....	<i>Pistacia sp.</i>
Hazel, beaked.....	<i>Corylus rostrata.</i>	Pistachio.....	<i>Pistacia sp.</i>
Hazel, California.....	<i>Corylus californica.</i>	Portia-nut.....	<i>Thespesia populnea.</i>
Hazel, Chile.....	<i>Gevuina Avellana.</i>	Purging-nut.....	<i>Jatropha Curcas.</i>
Hazel, Chinese.....	<i>Litchi chinensis.</i>	Quandang.....	<i>Fusanus acuminatus.</i>
Hazel, Constantinople.....	<i>Corylus Colurna.</i>	Quandong.....	<i>Fusanus acuminatus.</i>
Hazel, European.....	<i>Corylus Avellana.</i>	Queensland-nut.....	<i>Macadamia ternifolia.</i>
Hazel-nut.....	<i>Corylus sp.</i>	Rattle-nut.....	<i>Nelumbo lutea.</i>
Heart-nut.....	<i>Juglans cordiformis.</i>	Royal-nut.....	<i>Juglans regia.</i>
Hickory, big bud.....	<i>Carya alba.</i>	Royal-nut.....	<i>Walnut hybrid.</i>
Hickory, big shellbark.....	<i>Carya laciniosa.</i>	Rush-nut.....	<i>Cyperus esculentus.</i>
Hickory, bitter-nut.....	<i>Carya cordiformis.</i>	Sapucaia-nut.....	<i>Lecythis sp.</i>
Hickory, bottom shellbark.....	<i>Carya laciniosa.</i>	Sapucaya-nut.....	<i>Lecythis sp.</i>
Hickory, bull-nut.....	<i>Carya alba.</i>	Shea-nut.....	<i>Butyrospermum Parkii.</i>
Hickory, false shagbark.....	<i>Carya ovalis.</i>	Singhara-nut.....	<i>Trapa bispinosa.</i>
Hickory, king-nut.....	<i>Carya laciniosa.</i>	Snake-nut.....	<i>Ophiocaryon paradoxum.</i>
Hickory, little sealybark.....	<i>Carya ovata.</i>	Souari-nut.....	<i>Caryocarp nuciferum.</i>
Hickory, little shellbark.....	<i>Carya ovata.</i>	Tabebu.....	<i>Telfairia pedata.</i>
Hickory, mocker-nut.....	<i>Carya ovata.</i>	Tagua-nut.....	<i>Phytelephas Seemannii.</i>
Hickory, moekee-nut.....	<i>Carya alba.</i>	Taqua-nut.....	<i>Phytelephas Seemannii.</i>
Hickory, nutmeg.....	<i>Carya myristiciformis.</i>	Tallow-nut.....	<i>Sapium sebiferum.</i>
Hickory, pignut.....	<i>Carya glabra.</i>	Tavola-nut.....	<i>Terminalia Catappa.</i>
Hickory, sealybark.....	<i>Carya laciniosa.</i>	Temperance-nut.....	<i>Cola acuminata.</i>
Hickory, shagbark.....	<i>Carya ovata.</i>	Torrey-nut.....	<i>Torreya nucifera.</i>
Hickory, shellbark.....	<i>Carya laciniosa.</i>	Tung-yu.....	<i>Aleurites Fordii.</i>
Hickory, small pignut.....	<i>Carya ovalis.</i>	Tuscaine.....	<i>Carya ovata.</i>
Hickory, swamp.....	<i>Carya cordiformis.</i>	Vegetable, ivory-nut.....	<i>Phytelephas Seemannii.</i>
Hickory, water.....	<i>Carya aquatica.</i>	Walnut, American black.....	<i>Juglans nigra.</i>
Hyphane-nut.....	<i>Hyphane crinita.</i>	Walnut, Arizona.....	<i>Juglans major.</i>
Illinois-nut.....	<i>Carya Pecan.</i>	Walnut, Australian.....	<i>Juglans australis.</i>
Illipe-nut.....	<i>Bassia latifolia.</i>	Walnut, black.....	<i>Juglans californica, Hindsii,</i> <i>major, nigra and rupestris.</i>
Ilupi-nut.....	<i>Bassia latifolia.</i>	Walnut, Bolivian.....	<i>Juglans boliviana.</i>
Indian nut.....	<i>Pinus sp.</i>	Walnut, California black.....	<i>Juglans californica and Hindsii.</i>
Indian gum-nut.....	<i>Strychnos potatorum.</i>	Walnut, Caucasian.....	<i>Pterocarya fraxinifolia.</i>
Ita palm-nut.....	<i>Mauritia flexuosa.</i>	Walnut, Chile.....	<i>Juglans regia.</i>
Ivory-nut.....	<i>Phytelephas Seemannii.</i>	Walnut, Circassian.....	<i>Juglans regia.</i>
Jesuit's chestnut.....	<i>Trapa natans.</i>	Walnut, country.....	<i>Aleurites molluccana.</i>
Jicara-nut.....	<i>Crescentia Cujete.</i>	Walnut, eastern black.....	<i>Juglans nigra.</i>
Juba-nut.....	<i>Jubaa spectabilis.</i>	Walnut, English.....	<i>Juglans regia.</i>
Jur-nut.....	<i>Bunium Bulbocastanum.</i>	Walnut, European.....	<i>Juglans regia.</i>
Juvia-nut.....	<i>Bertholletia excelsa.</i>	Walnut, French.....	<i>Juglans regia.</i>
Kipper-nut.....	<i>Bunium Bulbocastanum.</i>	Walnut, Italian.....	<i>Juglans regia.</i>
Kola-nut.....	<i>Cola acuminata.</i>	Walnut, Japanese.....	<i>Juglans cordiformis, Sieboldi-</i> <i>ana, and mandshurica.</i>
Kolla-nut.....	<i>Cola acuminata.</i>	Walnut, Madeira.....	<i>Juglans regia.</i>
Korra-nut.....	<i>Cola acuminata.</i>	Walnut, Manchurian.....	<i>Juglans regia and Mandshurica.</i>
Kukui.....	<i>Aleurites molluccana.</i>	Walnut, New Mexico.....	<i>Juglans rupestris.</i>
Leechee.....	<i>Litchi chinensis.</i>	Walnut, Paradox.....	<i>Juglans hybrid.</i>
Lichi.....	<i>Litchi chinensis.</i>	Walnut, Persian.....	<i>Juglans regia.</i>
Litchee.....	<i>Litchi chinensis.</i>	Walnut, royal.....	<i>Juglans hybrid.</i>
Litchi.....	<i>Litchi chinensis.</i>	Walnut, royal.....	<i>Juglans regia.</i>
Litschi.....	<i>Litchi chinensis.</i>	Walnut, Spanish.....	<i>Aleurites molluccana.</i>
Lotus, American.....	<i>Nelumbo lutea.</i>	Walnut, Tahiti.....	<i>Aleurites molluccana.</i>
Lousy-nut.....	<i>Bunium Bulbocastanum.</i>	Walnut, Texas.....	<i>Juglans rupestris.</i>
Lumbang.....	<i>Aleurites sp.</i>	Walnut, white.....	<i>Juglans cinerea.</i>
Luzon-nut.....	<i>Canarium luzonicum.</i>	Walnut, white.....	<i>Carya laciniosa.</i>
Madeira-nut.....	<i>Juglans regia.</i>	Walnut, white.....	<i>Carya ovata.</i>
Manila-nut.....	<i>Arachis hypogaea.</i>	Walnut, winged.....	<i>Pterocarya fraxinifolia.</i>
Manketti-nut.....	<i>Manketti nut.</i>	Water caltrop.....	<i>Trapa natans.</i>
Marany-nut.....	<i>Semecarpus Anacardium.</i>	Water chestnut.....	<i>Trapa natans.</i>
Marking-nut.....	<i>Semecarpus Anacardium.</i>	Water chinquapin.....	<i>Nelumbo lutea.</i>
Marsh-nut.....	<i>Semecarpus Anacardium.</i>	Water-filter-nut.....	<i>Strychnos potatorum.</i>
Miriti-nut.....	<i>Mauritia flexuosa.</i>	Water-nut.....	<i>Nelumbo lutea.</i>
Monkey-nut.....	<i>Anacardium occidentale.</i>	Water-nut.....	<i>Trapa natans.</i>
Monkey-nut.....	<i>Arachis hypogaea.</i>	Wood-oil-nut.....	<i>Aleurites Fordii.</i>
Monkey-pot-nut.....	<i>Lecythis sp.</i>	Yer-nut.....	<i>Bunium Bulbocastanum.</i>
Monkey's cocoonut.....	<i>Jubaa spectabilis.</i>		
Mu-yu.....	<i>Aleurites molluccana.</i>		
Myrobalan-nut.....	<i>Terminalia Catappa.</i>		
Negro's head.....	<i>Phytelephas Seemannii.</i>		
Nelumbium-nut.....	<i>Nelumbo lutea.</i>		
Nelumbo-nut.....	<i>Nelumbo lutea.</i>		
Nickar-nut.....	<i>Guilandina Bonduc.</i>		
Nicker-nut.....	<i>Guilandina Bonduc.</i>		
Nigger-toe.....	<i>Bertholletia excelsa.</i>		
Nitta-nut.....	<i>Parkia africana.</i>		
Nutta-nut.....	<i>Parkia africana.</i>		
Oil-nut.....	<i>Pyralia oleifera.</i>		
Ombene.....	<i>Cola acuminata.</i>		
Palm-nut.....	<i>Elais guineensis.</i>		
Para-nut.....	<i>Bertholletia excelsa.</i>		
Paradise-nut.....	<i>Lecythis sp.</i>		
Paradox.....	<i>Hybrid walnut.</i>		
Peanut.....	<i>Arachis hypogaea.</i>		
Pecan.....	<i>Carya Pecan.</i>		
Pecan, bitter.....	<i>Carya aquatica.</i>		
Pekoa-nut.....	<i>Caryocarp nuciferum.</i>		
Philbert.....	<i>Corylus Avellana.</i>		
Philippine-nut.....	<i>Canarium luzonicum.</i>		
Phillo-nut.....	<i>Canarium luzonicum.</i>		
Physic-nut.....	<i>Jatropha Curcas.</i>		
Pignolia.....	<i>Pinus Pine.</i>		
Pignon.....	<i>Pinus Pine.</i>		
Pig-nut.....	<i>Carya glabra.</i>		
Pig-nut.....	<i>Bunium Bulbocastanum.</i>		
Pili-nut.....	<i>Canarium luzonicum.</i>		
Pili-nut.....	<i>Canarium ovatum.</i>		
Pinang.....	<i>Areca Catechu.</i>		
Pindar.....	<i>Arachis hypogaea.</i>		
Pine-nut.....	<i>Pinus sp.</i>		

NUTTALLIA: *Osmaronia.*

C. A. REED.

NYCTANTHES (*night flower*: blooms toward night and fls. fall at morning). *Oleaceæ*. One species, a small tree or shrub of India but now spontaneous in some other countries, sometimes planted in warm regions or grown under glass for its numerous white very fragrant flowers.

The species is *N. Arbor-tristis*, Linn., literally the "tree of sadness" because it blooms only at night; it is also known as the "night jasmine." *Nyctanthes* is much like *Jasminum* and some of the early names belong under that genus; it differs in its capsular fr. Lvs. opposite, ovate, cordate, short-stalked, entire or dentate, scabrous; branches 4-angled; fls. few in a sessile involucre cluster or head, which are disposed in dichotomous cymes; corolla whitish, the tube orange, salverform, the lobes 4-8; stamens (anthers) 2, nearly sessile near the top of the tube; ovary 2-celled, the style short and stigma 2-lobed; caps. roundish, $\frac{3}{4}$ in. long, with one erect seed in each of the 2 cells. B.M. 4900. B.R. 399.—It is an interesting plant, but little grown in our territory; blooms in summer; prop. by firm cuttings in sand with bottom heat. Reaches 30 ft. in India.

L. H. B.

NYCTERINIA : *Zaluzianskya*.

NYCTOCÈREUS (*night* and *cereus*). *Cactaceæ*. A slender cactus, at first erect, then clambering, with few branches; the st. has many low ribs with closely set areoles producing 10 or more acicular spines: fls. large, nocturnal, white; tube and ovary covered with small bracts, producing in their axils small clusters of spines: fr. red; seeds black.—Several species are known. They are among the several kinds of night-blooming cereus. See *Succulents*.

serpentinus, Brit. & Rose (*Cereus serpentinus*, DC.). Sts. 5-8 ft. long, slender, flexuous; ribs 10-13, low, obtuse; spines acicular: fls. 6 in. long. Mex. B.M. 3566.

guatemalensis, Brit. & Rose. A recently described species which has been widely intro. into Eu. and is being grown to some extent in this country. It grows easily in cult. It is not so tall as *N. serpentinus*, but the tips of the sts. are inclined to bend over and take root and start new plants.

J. N. ROSE.

NYMPHÆA (from *Nympha*, in Greek and Roman mythology, a nature-goddess). Syn., *Castalia*. *Nymphaeaceæ*. WATER-LILY. POND-LILY. NYMPHÆA. The most showy of aquatics (except Victoria), inhabiting the North and South Temperate and Tropical zones.

Herbs, perennial by horizontal or erect rootstocks or tubers, rooting in mud, covered by 3 in. to 6 ft. of water (rarely in bogs not submerged); lvs. floating, or when crowded rising a few inches above the water, round or oval, entire or dentate or sinuate, fissi-cordate, often sub-peltate, 2 in. to 2 ft. across; fls. mostly showy, white, yellow, blue, and red, in all shades, 1-12 or 14 in. across; sepals 4; petals and carpels many; stamens numerous; pistil with a broad cup-like depression in the center of the fl., surrounded by a ring of fleshy processes, the carpellary styles, and with a knob at the center.—About 40 well-marked species, with numerous local varieties and many cult. hybrids.

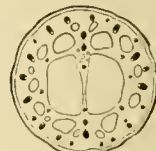
The petals and stamens of *Nymphaea* appear to be attached to the sides of the ovary; but this surface is to be considered as the outside of a cup-like receptacle, its cavity being completely filled by the radially placed carpels, with whose backs it is fused. Several species show easy gradations from sepal to petal and from petal to stamen, thus illustrating the homology of floral parts. The peduncles and petioles are traversed by a number of longitudinal air-canals, from whose walls star-shaped cells and rounded cell groups project inward; in the walls of these stellate internal hairs, are imbedded numberless minute crystals of calcium oxalate; they are objects of great beauty in microscopical

and a dense growth of long fine hairs. A group of roots comes off from the stem just below each leaf. The flowers are extra-axillary, arising as members of the leaf spirals or in a spiral of their own. The rhizomes of species which dry off in the resting season (*Lotos*, *Hydrocallis*; *Apocarpia*) become protected by a strong corky bark; others remain continually in a state of more or less active growth.

Habits of opening.—The flowers of every species open and close at a particular time each day, so that in a pond with eighteen or twenty kinds there is some change taking place at almost all hours. The hours of blooming are fairly regular, though the tropical species are more sluggish in cool weather, and the hardy ones are irregular in very hot times. Each flower opens from one or two to five or seven successive days (or nights), being about an hour later to open and an hour earlier to close on its first than on subsequent days. The flower then goes down into the water by a spiral coiling of the peduncle (or simply bending over if in shallow water), where the seed ripens. When in six to ten weeks the pod matures and bursts, the seeds rise to the water-surface and float for several hours by means of a buoyant aril. This finally decays and drops the seed at some distance from the parent. To secure these, the floating seeds may be dipped up in a wire sieve, or better, the pods may be inclosed in muslin or cheesecloth bags before ripening, all of the seeds being thus secured.

The hybrids.—The species of a single group hybridize very readily among themselves, and in the *Lotos* and *Eucastalia* groups the hybrids are more or less fertile. By means of this condition all shades of color have been obtained, from the pure white *N. Lotus* var. *dentata* to the dark crimson-red *N. rubra*. In this group and in *Castalia* varieties have so multiplied of late and fanciful names have been so freely given that an accurate classification of all of them is no longer possible. In the *Brachyceras* group, hybrids occur almost certainly if *N. zanzibariensis* is grown in the same pond with others of the group; thus have originated some very fine varieties. Outside of single groups, no genuine hybrids have yet been produced. Between the apocarpous and syncarpous species, a hybrid would be impossible. Authorities differ as to the best time to transfer pollen. Certain it is that the flowers are pistillate on the first day of opening, the pollen being shed on succeeding days or late on the first day. Some say that pollination should take place in the early morning hours, about daybreak; others consider the time most favorable just as the flower is closing for its first time.

Trouble with the names.—The water-lilies and yellow pond-lilies or spatterdocks were together included by Linnaeus under the genus name *Nymphaea*. In 1805 Salisbury first separated these two parts of the genus. The water-lilies he called *Castalia* and the spatterdocks *Nymphaea*. J. E. Smith, writing two years later, disregarded Salisbury's work and called the two groups *Nymphaea* and *Nuphar* respectively. Thus *Castalia*, Salisb.=*Nymphaea*, Smith, and *Nymphaea*, Salisb.=*Nuphar*, Smith. Salisbury, contrary to good usage and the present International Rules (article 45), coined a new name for the group containing the larger number of species, and arbitrarily changed nearly all of the specific names. His names, however, never came into general use, but Smith's were generally adopted. Strict adherents of the "law of priority" have recently revived the generic names of Salisbury. The principle of fifty years of accepted usage may well be extended



2543. Transverse section of petiole of *Lotos* group.



2544. Transverse section of peduncle of *Lotos* group.



2541. Transverse section of petiole of *Castalia* group.



2542. Transverse section of peduncle of *Castalia* group.

sections. The distribution of these, as also of the air-canals, differs in different species. (Figs. 2541 to 2544.) Three types of leaf may be distinguished: (1) Very thin and fragile submerged leaves on short petioles; (2) floating leaves, thicker in texture, with stomata and palisade cells on the upper surface only; (3) aerial leaves, leathery in texture, sometimes, at least, bearing stomata on the under surface.

The leaves spring from the rhizomes in spiral orders of varying complexity, from two-fifths up. The growing apex of the stem is protected by the colorless stipules

to this case, making it unnecessary, as it is also unfortunate, to revive the old name *Castalia* for these well-known and popular plants, which are habitually monographed under *Nymphaea*. The name *Castalia* is not adopted by most European botanists. Briquet, of the international committee on nomenclature and under whose name the international rules are issued, writes the author that the rules definitely mean to authorize *Nymphaea* rather than *Castalia*.

Until the first edition of this Cyclopaedia, several specific names were confused, but this difficulty is mostly corrected now. In reading of aquatics prior to 1900, it is well to remember that many British botanists include all blue water-lilies of the eastern hemisphere (or all except the Australian forms) under the name *Nymphaea stellata*. *N. cerulea* of B. M. 552 and *N. scutifolia*, DC., are really *N. capensis*. The true *N. cerulea* was long known in American gardens as *N. scutifolia* (Triecker, "Water Garden," 1897). *N. ampla* of gardens may be either *N. amazonum* or *N. Lotus* var. *dentata* (see "Waterlilies: A Monograph of the Genus *Nymphaea*," by H. S. Conard. Carnegie Inst. Publication No. 4).

The true Egyptian lotus.—Among common names the term "lotus" has been remarkably misapplied. It seems to be consistently used among us for the genus *Nelumbo*, *Nelumbo nucifera* being generally styled "Egyptian" or "sacred lotus." Historically this is entirely wrong. *Nelumbo* is not native in Egypt, and is not now found there in a wild state. It was cultivated extensively along the Nile in the Roman period, probably for food, and the flower is supposed to have furnished the design for one form of capital of the Egyptian columns. It is a native of southeastern Asia; is found near temples and carved on the walls of cave-temples in Hindustan, showing a veneration, which it shares, however, with *Nymphaea stellata*, *N. rubra* and *N. Lotus*. *Nelumbo* seems to have been regarded as sacred about temples in Japan and China. In Egypt, however, *Nymphaea cerulea* and *N. Lotus*, the "blue lotus" and "white lotus," are indigenous. The root (rhizome) of the former is said to have been pointed out as edible by Isis—or by Menes; its flowers, buds and leaves are often depicted on the monuments, the first sometimes in color. The flowers are figured among offerings under the fourth dynasty (3998–3721 B.C.), and the plant is certainly known from the fifth dynasty. Petals of this and of *N. Lotus* were found in the tomb of Rameses II, the Pharaoh of the Israelitish captivity. *N. Lotus* was less regarded than *N. cerulea* in Egypt, though an object of veneration in India. Herodotus and other ancient writers speak of these water-lilies indiscriminately as the "lotos" of the Egyptians. With these facts, and the additional one that, except as referred to above, *Nelumbo* never appears in Egyptian carvings, the identity of the sacred lotus cannot be doubted. But the erroneous use of the word lotus is deeply rooted and may never be supplanted, and it is necessary to remember that the so-called "Egyptian lotus" is not the plant of the tombs and monuments. (The lotus of Tennyson's poem, "Lotus Eaters," is still another plant, a shrub or tree, which hangs out over the water; and the genus *Lotus* [which see] is distinct from all of these.)

The Marliac hybrids.—Two types of hardy free-flowering hybrids akin to *N. alba* and its variety *rubra*, but of uncertain parentage, have been introduced since 1888, one of sturdy habit, raising its leaves (4 to 8 inches across) and flowers (3 to 6 inches across) well out of the water when crowded, the other slender in growth, the leaves (3 to 6 inches across) and flowers (2½ to 4 inches across) usually floating. From 1888 to 1900 all of these superb varieties were introduced by M. Latour-Marliac of Temple-sur-Lot, France, whose methods, however, remain a mystery. Excellent culture combined with careful selection and wise hybridization have brought about these magnificent results. The first or Marliacea

group seems to involve *N. alba* as one parent. The second started with a hybrid of *N. alba* var. *rubra* and *N. tetragona* known as *N. Laydekeri* var. *rosea*, to which is added in varying degrees blood of *N. alba* var. *rosea* and *N. mexicana*. But this does not adequately account for the whole group. Nearly all kinds of both groups are entirely sterile.

Important species.—The following account, which contains 200 varieties and about 48 synonyms, may seem rather formidable to the beginner, but the species of first importance are only eight in number: *N. Lotus*, *N. rubra*, *N. tuberosa*, *N. odorata*, *N. alba*, *N. mexicana*, *N. flavo-virens* and *N. zanzibariensis*. The greater number of the other names represent garden varieties and hybrids. It is impossible for any form of arrangement to be clear and logical on the one hand, and exhibit natural relationship on the other, at least, in a genus so greatly modified in cultivation. However, the true species may be distinguished in the treatment, the derivatives being apparent by description or hybridization sign (×) or otherwise.

The best water-lilies for amateurs.—Tender day-blooming kinds: *N. pennsylvanica*, light blue; *N. zanzibariensis*, deep blue; *N. flavo-virens*, white; Mrs. C. W. Ward, pink; *N. Daubeniana*, dwarf, blue. Tender night-blooming kinds: *N. dentata*, white; *N. Omarana*, magenta; Frank Trelease, dark crimson. Hardy kinds: *N. chromatella*, yellow; *N. tetragona helvola*, dwarf yellow; *N. Gladstoniana*, white; *N. tetragona*, dwarf white; W. B. Shaw, pink; *N. Laydekeri rosea*, dwarf pink; Wm. Falconer, dark red.

Cultivation of water-lilies. (William Triecker.)

Water-lilies or nymphaeas are among the most royal, gorgeous, diversified, and universally admired plants in cultivation. No class of plants in our public parks can compete with them in attracting the people. Moreover, America is the most highly favored country in the world for the cultivation of aquatic plants. Ours is the only country which can have so rich and continuous a display of aquatics in flower from April to October in the open without artificial heat. In parks and private gardens are to be seen, flowering early in spring, all native nymphaeas, and others from Europe and Asia. The species begin to flower in April and continue until early fall, when a number of the hardy hybrids continue to flower uninterruptedly until the end of the season. In the central states and southward, the hardy varieties decline when tropical weather sets in, and the nights and days are hot. In the eastern states, and especially near the coast, where the nights are cool, the season is much longer, and the color of some of the pink varieties is more intense. Following the hardy nymphaeas come the nelumbiums in all their oriental splendor, brightening the summer season, and bridging over the declining period of the hardy nymphaeas and the approaching season of the tropical nymphaeas which arrive at maturity toward the latter end of July or beginning of August, and continue until fall. Finally the grandest of all aquatic plants, *Victoria regia*, may be seen in America growing in a natural pond, and producing its chaste flowers as late as the middle of October.

America is rich in native species of nymphaea, and it is the only country which has native white-, pink- and yellow-flowered kinds. Of the American nymphaeas there are about five that are best known. The common white water-lily is *Nymphaea odorata*. Its variety *rosea* is the Cape Cod pink water-lily. *N. tuberosa* (syn. *N. reniformis*) is a white-flowered species, inhabiting the western lakes. The yellow kind, *N. flava*, is indigenous to Florida and other southern states, but is hardy in New Jersey and southern New York. Another southern kind is the white-flowered *N. odorata* var. *gigantea*. In addition to the above well-known kinds, there are several distinct forms and hybrids.

The commencement of the cultivation of aquatics in

America led to the commingling of species, especially of *N. odorata* and *N. tuberosa*. The result is that in several sections are to be found many similar varieties, and forms of both white and pink, some of which are valuable, being distinct in color and having large, handsome, fragrant flowers, while a host of others are worth-



2545. Stamens and vertical section of ovary of *Anecphyra* group.

less, so far as distinct varieties are concerned. *N. tuberosa* is known as the largest and purest white water-lily, distinct in foliage, flowers and rootstock. This species has proved to be the most susceptible of cross-fertilization. One great hindrance to the cultivation of such half-breeds, is that most of them produce seed. The seedlings are either white or pink, and seldom, if ever, like the parent plant. There are in different sections of the country distinct forms of *N. tuberosa*, some having long, narrow petals and slightly fragrant flowers, others again having broad incurving petals, forming handsome cup-shaped highly fragrant flowers; still others have very full flowers, quite double, the numerous petals crowding each other until the reflexed sepals inclose the stalk, forming spherical flowers like balls of snow. *N. tuberosa*, in any of its forms, should not be planted in a small pond with other nymphaeas, for it is such a rampant grower that in a short time it will smother the less vigorous kinds. This species delights in plenty of space, and water 2 to 3 feet deep, with soil of a tenacious character. However, it will thrive in almost any soil, and is well adapted for naturalizing in lakes and ponds. Attempts at naturalizing or cultivating on a small scale have not been very satisfactory; but the species will well repay any extra care to establish it in desirable localities.

Two or three species are indigenous to continental Europe, notably *N. alba*, the well-known English white water-lily, *N. candida*, the white Bohemian water-lily, and *N. alba* var. *rosca*, the Swedish water-lily. The last named is the only distinct or true red-flowered, hardy species. Still another species, which has played a very important part with specialists of the present day, is *N. tetragona* (*N. pygmaea*), from China and Japan.

Nymphaea odorata was introduced into England during the eighteenth century, and was probably the first foreign nymphaea to reach that country. Other species followed later, mostly tropical; but, although the English people were ardent horticulturists and lovers of the beautiful in nature over a century ago, nymphaeas never became popular, and remained a neglected class of plants until a few years ago, when N. Mariac, of Temple-sur-Lot, France, conceived the idea of crossing the English white water-lily with the well-known Cape Cod pink water-lily, and the Florida yellow variety. Nothing in the horticultural world has created more surprising results in the blending of the American and English species. These species have been the progenitors of numerous varieties, which have made this class of plants the most popular and desirable of all aquatic decorative subjects, and within reach of all. Their popularity has kept constantly increasing and ever heightened by new additions. America, also, has contributed its quota to the



2546. Stamens and vertical section of ovary of *Brachyceras* group.

list of novelties, and some of these are unsurpassed by any European introductions.

From the apparently simple conditions under which our native species are found growing, many amateurs have concluded that all these plants require is water and possibly some mud to keep the roots in. Many attempts have been made to grow these plants in pails and tubs, with inevitable failure, as a result. Professional gardeners, also, have made grievous errors, for, while they have used every means to secure fine specimen plants of flowers, vegetables and luscious fruits, they have usually given meager attention to water-lilies, and have not supplied half their wants. Water-lilies, all nymphaeas, succeed best when grown, as near as possible, under their existing natural conditions; these are a rich alluvial soil in abundance, water, and clear uninterrupted sunlight. Where natural ponds exist these conditions are found, but often there is a deficiency of light, caused by shade trees. Let the trees remain, but choose open spots for the nymphaeas. They may be planted on the margins of sluggish streams, in bays and sheltered nooks.

Where artificial ponds are used, the most satisfactory method is to build solid walls of reinforced cement, with a concrete bottom, provided with an outlet and overflow. In all cases make the pond as large as existing means will allow, not for a moment considering it possible to be too large. One method of providing for the sustenance of these plants is to place a layer of soil in the bottom of the pond from 9 to 12 or more inches deep. This will suit the plants admirably. Artificial ponds are usually constructed in a conspicuous spot, where everything is required to be well kept.



2547. Stamens and vertical section of ovary of *Castalia* group.

In such situations it is necessary occasionally to take off some dead leaves, or cut a few choice flowers, and if they cannot be reached from the edge of the pond, the attendant must wade in after them. The result is that the water, which should always be clear, is muddy, and when it settles there is a muddy deposit on the leaves that makes them very unsightly. Moreover, this treading in the soft soil breaks numerous roots. To avoid these and other attendant evils, place the soil in boxes from 3 to 4 feet square, and 1 foot deep, and in these plant one single plant of the vigorous and moderate growers, allowing ample space between the boxes. One plant of any tropical water-lily in such a box, or three of smaller species, will require 50 to 100 square feet of water surface, as will also strong hardy nymphaeas, since these may remain two years undisturbed, although some of these are best replanted every season. The pond should be 2 to 2½ feet in depth. The soil should be a strong loam, the top-soil from a pasture composted with cow-manure in proportion of one-third. This should be prepared six months, at least, before planting time. This soil is suitable for all aquatic plants. In any case, when filling the boxes or placing the soil in bottom of pond, tread moderately firm and cover with an inch of sand. The water may be spring-water, rain-water or that from any available source. The clearest spring-water will soon turn green from exposure to the sun and air, but after fermentation settles clear. Do not place the plants in a newly constructed pond or basin immediately after it is finished, as the caustic property of the cement will injure the plants. Wash the new construction thoroughly and then supply it with clean fresh water. Planting of the hardy varieties may be done in April and May, according to the latitude and earliness or lateness of season. The conditions should be conducive to active growth at once.

Tropical nymphaeas should not be planted until there is evidence that summer has come. Hardy nymphaeas may be planted in spring and summer (not in autumn); late planting is better than deferring till next spring, as the plants under such conditions will get established before autumn closes, and the plants will start naturally in spring, receiving no check.

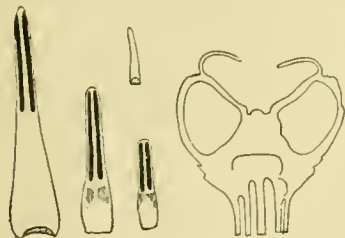
The above method of construction and cultivation is to be commended, but other methods are adopted with a fair degree of success, but with attendant evils which are discouraging and at times very annoying and costly. Tanks or artificial ponds may be constructed with cement, digging the pond the desired size, having sloping sides and afterward lining the same with concrete and finishing with a facing of cement. However, such a pond will not stand the effects of hard freezing weather even if protected; and what is worse, the new or freshly removed soil will settle during the season, and the pond is very likely to spring a leak.

Another method of construction is to line the pond with well-tamped clay, from 4 to 6 inches thick, afterward covering with 2 inches of sand. The labor for such construction is expensive, however, the clay may not be good, and the pond is likely to be muddy; it is now better to build of cement.

There are yet the advocates for tub-culture. Plants will grow in tubs, and as soon as the plant-food is exhausted, which is often at an early date, the plants exist awhile and then draw out a miserable, exhausted and discouraging career. Fountain basins are often made the receptacles for nymphaeas. There they may be grown if the right conditions are accorded them, but there must not be a stream or spray of water running all the time, as the water may be cold, chilling the plants and checking their growth.

Nymphaeas have insect pests like other cultivated plants. Aphides are sometimes troublesome. The best remedy is their natural enemy, the "lady-bugs" or "lady-birds." A colony of these voracious insects makes short work of the aphides, as do also the lace-winged flies. An insect of recent acquaintance with nymphaeas is a leaf-miner, the larva of a small fly, which cuts channels through the leaf in all directions. Sometimes only a few of these are in evidence; at other times the leaves are fairly alive with them. The trouble is easily detected. A simple remedy is kerosene emulsion, applied with a fine spray at evening after the flowers are closed. Another troublesome insect is a leaf-cutter, *Hydrocampa obliteralis* (or *proprialis*). The larva cuts out pieces of the leaf and hides between two pieces,

which makes a kind of tent. In this tent the larva moves about. At first it moves slowly, but as it nears maturity the larva becomes ravenous and then eats the surface of the leaves near the center, and cuts off much larger pieces of the leaf. The best



2548. Stamens and vertical section of ovary of *Lotos* group.

remedy is a lamp trap for the mature insect. Frogs and dragon-flies will catch numbers of them. Arsenate of lead spray will destroy the larvæ.

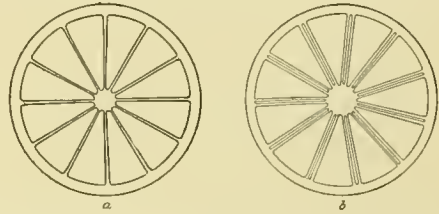
Nymphaeas are also subject to a fungous disease, a leaf-spot which is easily discerned after a spell of warm, humid weather. The leaves are scorched and crumpled, the plant is denuded of its foliage; new leaves are weak and smaller, and so too are the flowers, if indeed there are any. This disease must be checked at once or the plants will be severely set back, if not ruined. A remedy is bordeaux mixture. Use a fine spray, and dilute

the mixture to half the strength recommended for most plants. It is best to spray twice with a weak solution rather than to spray once with a too strong solution and to damage the foliage. A light dusting on the leaves with carbonate of copper will soon remedy the trouble.

In winter, tender nymphaeas should be kept in tanks or tubs under glass. For hardy species, cover the tank with boards and pile on dry leaves, coarse hay or other material; or the roots may be taken out and buried in a sheltered place.

Water-lilies in California. (Edmund D. Sturtevant.)

The culture of nymphaeas in California presents fewer difficulties than in the eastern states. The varieties which are hardy in the East flourish equally well and bloom for a longer period. In frostless localities, especially where the lemon tree is free from injury, such



2549. Transverse section of ovaries. *a*, syncarpous, *b*, apocarpous.

tender varieties as *Nymphaea devoniensis*, *N. dentata* and *N. zanzibariensis* may be left in the open pond during the winter. In colder localities, the tubers should be removed to warmer quarters in November to remain until spring. If a greenhouse is not available, a small pool built in such a manner that it can be covered with hotbed sash will afford suitable protection. Very little room is needed for these when they are dormant. The manner of cultivating both the hardy and tender varieties is much the same in California as in the eastern states. For growing a small collection, a pool 8 or 10 feet across may be made by excavating 2 or 3 feet, making the walls of concrete, brick or stone, and covering the bottom with concrete. The best quality of cement should be used for all the work. An overflow pipe should be put in and so arranged that the pool may be emptied when occasion requires. Basins 20 or 30 feet in diameter, or even larger than this, are desirable for growing a good collection. In a small pool, wooden boxes 10 inches deep and 18 inches to 2 feet square may be used to hold soil for the plants. In a large basin some of the boxes may be 3 or 4 feet square. While most aquatics will flower freely in contracted quarters, they will attain greater perfection and produce much larger flowers if they have abundance of room.

Most of these plants are gross feeders, and it is well-nigh impossible to make the soil too rich for them. It is not necessary to go to a swamp or natural pond to obtain what is suitable. Any soil that will grow good vegetables will, if properly enriched, grow water-lilies. A compost, consisting of two-thirds good soil and one-third thoroughly decayed cow- or stable-manure, with a sprinkling of bone-meal, is recommended. A dark friable loam, which is intermediate between "adobe" and sandy loam, is desirable for this purpose. The tenderest varieties, such as *N. devoniensis* and *N. dentata*, will flower for a long period without any forcing; but if started into growth in March in a greenhouse or hotbed and planted in the pond in May, there will be a great gain in the length of the flowering season. The soil for the tender varieties should be renewed every year, and that for the hardy ones every two years.

If aphides or the pest known as the leaf-roller make their appearance, the leaves, should be sprayed with kerosene emulsion very much diluted, using one part emulsion to fifteen of water. If large ponds or lakes with

a natural earth bottom are used for growing water-lilies, care must be taken that noxious weeds do not get a foothold. Cat-tails (*Typha latifolia*) and "tules" or bulrushes are troublesome if not destroyed when they first make their appearance. Palms, both fan-leaved and feathery, giant bamboos, musas, strelitzias, papyrus, giant grasses, fatsia and caladiums are among the things which can be used to ornament the surroundings of the water-garden.

The genus *Nymphaea* divides itself readily into two main divisions, which again are subdivided into five subgenera as follows:

Section I. APOCARPÆ. Carpels free at the sides, united at their edges to the central column of the fl. and at their backs to the receptacle: outermost stamens ripening first, innermost last: rhizome ovate, stoloniferous.—Tender day-bloomers: fls. on strong scapes 4–12 or 14 in. above the water (*Lythopleura*, Casp.).

Subgenus I. ANECPHYA. Stamens all slender, half as long as the petals, almost without any appendage (Fig. 2545): carpellary styles wanting: fls. blue, rosy or white.—Two species, in N. Austral.

Subgenus II. BRACHYCERAS. Outermost stamens with an appendage above the anther (Fig. 2546): carpellary styles short, triangular: fls. white, blue, pink or yellow.—About 15 species in the tropics all around the world.

Section II. SYNCARPÆ. Carpels entirely fused together (*Symphlytopleura*, Casp.).

Subgenus III. CASTALIA. Sepals not evidently nerved: carpellary styles flat, linear: outer stamens petaloid; innermost stamens first to ripen, their filaments short, narrower or but slightly wider than the anthers (Fig. 2547).—Hardy or half-hardy day-bloomers: fls. white, pink, red or yellow. In the entire North Temperate Zone, excepting the Pacific slope of N. Amer.

Subgenus IV. LOTOS. Sepals prominently veined; a space between the insertion of the petals and stamens; stamens broad, flat, rounded at apex (Fig. 2548): carpellary styles linear: lvs. sharply dentate: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. red or white on strong scapes 3–12 in. above the water, opening on 4 successive nights. Two or 3 species in S. Eu. and Asia and N. and Cent. Afr.

Subgenus V. HYDROCALLIS. Sepals not evidently nerved: carpellary styles long, club-shaped: petals in alternating circles of 4: stamens much as in Castalia, all opening about the same time: rhizome ovate, stoloniferous.—Tender night-bloomers: fls. creamy white. About 9 species in Trop. Amer.

The initial C in the synonymy=Castalia.

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somptuosa, 26.
speciosa, 7, 21.
sphaerocarpa, 25.
splendens, 24.
stellata, 4, 6, 10.
stenaspidotha, 36.
Stuhlmannii, 11.
Sturtevantii, 33.
suavisima, 21.
sulfurea, 11.
sulphurea, 13.
superba, 17, 21, 30.
tenerinervia, 36.
tetragona, 2, 14, 16.
27.
thermalis, 29.
tuberosa, 21, 22.
tulipifera, 33.
turicensis, 21.
versicolor, 6.
violacea, 2, 9.
vomereana, 16.
zanzibariensis, 9.
Zenkeri, 32.

SECTION I. APOCARPÆ.

SUBGENUS I. ANECPHYA.

1. *gigantæa*, Hook. (*Castalia gigantæa*, Brit.). Lvs. narrowly peltate, elliptic or ovate, margin sinuate-dentate, sinus open; under surface brownish pink to purple; 18 in. across: fls. light blue, open 7 days from 9 A.M. to 6 P.M., 6–12 in. across; sepals pure green; petals 18–50, dark blue at tip, shading to nearly white at base; stamens 350–750; filaments mostly filiform; anthers bright yellow. Austral. B.M. 4647. F.S. 7:751. G.C. III. 28:77; 34:63; 53:422 (var. *Hudsoniana*). Gn. W. 20, suppl. Sept. 5 (var. *Hudsonii*). G.W. 1:122; 9:447; 15:511. Gn. 64, p. 114 (var. *Hudsonii*).—The most delicate and lovely, and withal one of the largest of the genus. The original large-flowering type (sometimes called var. *Hookeri*) is difficult to cult. The form now in gardens is smaller and easier to manage; it is called by Henkel *N. Casparyi*, and in Austral. is sometimes called *N. gracilis*. White and pink forms (*N. alba* and *N. rosea*, Benth. & Mnell.) occur in Austral. An English var. *Hudsoniana*, said to be a cross with *N. stellata* is evidently only a seedling of *N. gigantea*.

2. *violacea*, Lehm. (incl. *N. Holtzei*, Rehn. & Henk. *N. Rehnelliana*, Henk. *N. Brownii*, Bailey. *N. Banksii*, Cunn. *N. serrata*, Muell. *N. repanda*, Muell.). Smaller: sepals marked with black lines: lvs. wavy margined or almost entire. Cape York Peninsula.—A beautiful white form of this is called "Eleonore." A very small white one from Arnheim's Land was misnamed *N. tetragona* by Baron von Mueller.

SUBGENUS II. BRACHYCERAS.

A. Lvs. entire or slightly wavy at base.

3. *élegans*, Hook. (*C. elegans*, Greene). Fig. 2551. Lvs. narrowly peltate, orbicular to ovate; margin entire or with 5 or 6 small scattered teeth; under surface dark purple; 7 in. across: fls. pale violet; 3–6 in. across, open 3 days from 8 A.M. to 1 P.M.; buds ovate; sepals marked with black lines and dots; petals ovate, obtuse, 12–20; stamens stout, about 75, yellow; appendage a mere tip; filaments broad. Mex., Texas. B.M. 4604. J.F. 2:180. G.F. 8:206 (adapted in Fig. 2551).

4. *cærûlea*, Sav. (*C. cærûlea*, Woodv. & Wood. *N. stellata*, Casp., etc.). BLUE LOTUS of Egypt. Lvs. narrowly peltate, oval, entire or slightly sinuate at base; under surface green, with dark purple blotches, purplish at margin, 12–16 in. across: fls. 3–6 in. across, open 3 days from 7.30 A.M. to 12 M.; buds conical; sepals thickly marked with black lines and dots; petals 14–20, lanceolate, acute, light blue above, basal half dull white; stamens 50–70; outer filaments broad, yellow; appendage long ($\frac{3}{16}$ in. on outer stamens), pale blue. Egypt, N. and Cent. Afr. Ann. Mus. Paris, Vol. I (1802), p. 366 c.p. F.S. 7:653.—Free grower and bloomer but not showy. Forms occur in Afr. with pure

white or bright red fls., and some without spots on the calyx.

5. *micrantha*, Guill. & Perr. Lvs. elliptic, entire in apical half, rest of margin sinuate; sinus deep; lobes spreading, much produced and acuminate, bearing bulbs which produce new plants at the top of the petiole; under side of lf. green, tinged with purplish brown and minutely dotted; fls. small, white, 3-5 in. across; calyx pale green, unspotted; petals lanceolate, very acute. West coast of Afr. B.M. 4535.—*N. Daubeniana*, Hort., intro. in 1912 by W. Tricker, is a pale blue form of this, possibly a hybrid with *N. cœrulea*.

AA. Lvs. distinctly or deeply sinuate.

B. Sepals marked with black dots and lines.

6. *stellata*, Willd. (*C. stellata*, Woodv. & Wood, incl. *N. versicolor*, Roxbg.). BLUE LOTUS of India. Lvs. elliptic-orbicular, rather broadly peltate; margin irregularly repand-dentate; lobes scarcely produced; green above, deep blue-violet beneath: fl. 3-7 in. across, pale blue (rarely pink or white), open 3 days from 8 A.M. to

and small-sized forms. Var. *Gerardiāna*, Hort. Fls. raised above water, very large, white and yellow anthers.

Two garden hybrids may be described here: *N. pulcherrima*, Tricker (*N. cœrulea* × *N. capensis*?). Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface green, densely blotched with purplish black; margin purplish red; 16 in. across; fls. light blue, 10-12 in. across; buds sharply conical; petals 22, lance-ovate, whitish at base; stamens about 140, appendaged. G.C. III. 28:273. G.M. 55:703.—*N. pennsylvania*, Conard (*N. cœrulea* × *N. zanzibariensis*). Fls. large, deeper blue, open from 8 A.M. to 5 P.M.; petals 23; stamens 140.—The best blue in this group.

BB. Sepals without black markings.

8. *capensis*, Thuub. (*N. seutifolia*, DC. *N. cœrulea* of B.M. 552). CAPE BLUE WATER-LILY. Lvs. rather narrowly peltate, orbicular-ovate, strongly sinuate-dentate; angle of lobes produced, acuminate; 12-16 in. across; fls. rich sky-blue, 6-8 in. across; open 4 days from 7 A.M. to 4 P.M.; buds ovate; sepals pure green



2550. Nymphaeas in an effective and natural setting.

2 P.M.; buds ovate; sepals with minute blackish dots; petals 11-14, dull white at base; stamens 33-54; appendage blue; anthers and filaments pale yellowish. S. and E. Asia. Andr. Bot. Rep. 5:330. B.M. 1189 (pink); 2058. R.H. 1855:261. F.S. 8:854. Gn. 54, p. 97; 56, p. 277. G.M. 41:607.—White and pink forms occur in India.

7. *amplea*, DC. (*C. ampla*, Salisb.). Lvs. narrowly peltate, suborbicular, sinuate or nearly entire, with small black spots above and below, 6-15 in. across; fls. white, 3-8 in. across; sepals coriaceous, ovate-lanceolate, acute; petals 7-21, lance-ovate; stamens 30-190, outermost ones much longer than innermost. Texas, south to W. Indies and Brazil. Fl. Brasil. 77:129, pl. 28-30. B.M. 4469.—Very near kin to *N. gracilis* and *N. flavovirens*. Vars. *speciosa* and *pulchella* are medium-

outside, whitish within; petals 20-30, lower third nearly white, narrowly elliptic; stamens about 150; filaments yellow, outermost ones broad, innermost filiform; appendage and back of outer anthers blue. S. Afr. Andr. Bot. Rep. pl. 197. F.S. 6:645.—A very desirable species.

9. Var. *zanzibariensis*, Casp. (*N. zanzibariensis*, Casp.). Lvs. somewhat peltate, orbicular or orbicular-ovate, margin closely sinuate-dentate; angle of lobes scarcely pointed; under surface more or less suffused violet; 8-15 in. across; fl. 6-12 in. across, open 3-5 days from 11 A.M. to 5 P.M.; sepals green outside, margins purple, deep purplish blue within; petals 18-24, oblong, obtuse, deep blue; stamens 136-242, appendage dark blue; back of anther dark crimson-violet; outer filaments obovate and yellow. Zanzibar. B.M. 6843. Gn.

25:210. R.H. 1897, p. 328. Var. *azùrea*, light blue, and var. *rôsea*, pink, are otherwise like the type, but open earlier in the morning; they come up promiscuously from seed of the type or of one another.—As now cult., the var. *zanzibariensis* shows the greatest variation in color of sepals and petals, as well as in shape and number of petals and stamens. The petals vary from obovate to elliptic-lanceolate. Colors shade from the deep purplish blue of the type to pale azure on one hand, or to purple, pink, and almost red on the other. The inner surface of the sepals varies from greenish white to almost pure white, or shaded toward the tip with pink, red, pale blue, or deep blue-purple. All combinations of sepal and petal coloring occur, apparently without any correlation. Many of these forms have been named, e.g., Amethyst, L. Dittmann, Kobald, Countess of Warwick, Lord Brooks, *N. Listerii*, *N. z. violacea*, *N. z. calēstina*, etc. They can be reproduced true only by offsets. A small percentage of seedlings resemble the parents.

10. $\times$ *berolina*, Hort. (*N. capensis* $\times$ *N. zanzibariensis*? *N. stellata*, Berlin variety). Lvs. somewhat peltate, orbicular-ovate, strongly sinuate, angle of lobes acuminate; under surface dark purple; 8–16 in. across; fls. deep blue, open 3–5 days, from 9 A.M. to 4 or 5 P.M., 6–8 in. across; sepals green outside, blue within; petals 15–20, narrow, acute; stamens 60–100; appendage blue.—Free bloomer, strong grower; sterile. Originated many years ago in Germany, probably with Caspary.

11. *flavo-virens*, Lehm. (*N. gracilis* of gardens, not Zucc.). Fig. 2552. Lvs. narrowly peltate, deeply and irregularly sinuate or nearly entire, suborbicular; angle of lobes rounded; under surface pure green (or purplish in hybrids); 15–17 in. across; fls. white, 6–8 in. across; sepals pure green; petals 16–20, acuminate; stamens about 60, deep yellow; outermost filaments short, broad, petaloid; anthers with long yellowish appendage. Mex.—Crossed with *N. capensis* var. *zanzibariensis*, this species has yielded a progeny showing much the same variation as is shown by *N. zanzibariensis* itself. These are distinguished from forms of the latter by their more slender and acute petals and sepals, and smaller number

of floral parts. They propagate easily from the tubers, bloom very freely, and include the best of the tender, day-blooming nymphaeas. The deepest blue is Grossherzog Ernst Ludwig; Wm. Stone is bright blue; Mrs. C. W. Ward, pink; *N. gracilis rubra*, red. Several other named forms have been offered, e.g., Antoine Chaize, A. Siebert, *N. gracilis rosea*.



2552. *Nymphaea flavo-virens*.

Of other members of Brachyceras, the following should be mentioned: *N. Heudelottii*, Planch. Fl. 2–2½ in. across, pale blue; lvs. 2–4 in. Senegambia.—*N. calliantha*, Conard. Fl. 4–7 in. across, blue or pink; lvs. 6–12 in. Cent. Afr.—*N. sulfurea*, Gilg. Fl. 2–3 in. across, cadmium-yellow; lf. 2–3 in. S. Cent. Afr.—*N. Stuhlmannii*, Schw. Fl. 5–6 in. across, sulfur-yellow; lf. 10–12 in. Cent. Afr. The origin and relations of the true *N. gracilis*, Zucc., are uncertain; it is not in cult.

SECTION II. SYNCARPLE.

SUBGENUS III. CASTALIA.

A. Fls. yellow (*Xanthantha* and hybrids).

B. Spreading by runners (natural species).

12. *mexicana*, Zucc. (*C. mexicana*, Coulter. *N. flava*, Leitner). Floating lvs. ovate, margin obscurely and finely sinuate, dark green above, beautifully blotched with brown; under surface dark crimson-brown, with small blackish dots; when crowded the lvs. rise 3–5 in. above the water, are orbicular, cup-shaped by overlapping of the straight sinus-margins, entire, 3–5 in. across, dark green and shining above, under surface bright green, with fine purplish brown mottlings; fls. 4 in. across, raised 4–5 in. above the water, bright canary-yellow, open from 11 A.M. to 4 P.M.; petals 23, grading in size and shape insensibly into the stamens, which are about 50, light golden yellow; rhizome erect, tuber-like, discoid, plane beneath, 3–5 in. diam.; runners terete, ½ in. thick, white, rooting at the tip and sending up lvs.; the young plant flowers in a few weeks and again sends out runners. Fla., Mex. B.M. 6917. Gn. 23:334; 27, p. 439; 52:445.—Hardy as far north as New York “in 2 ft. of water, covered with boards and a few leaves.” Mexican stock is stronger and blooms more freely than that from Fla. Rose considers them distinct species.

BB. Without runners (hybrids).

13. $\times$ *odorata* var. *sulphurea* (*N. sulphurea*, Hort.). Lvs. all floating, 4–6 in. across, like those of *N. odorata*, but blotched with brown; fls. light yellow, 4–5 in. across, borne 2–4 in. above the water; open during the morning. One of Marliac's hybrids, doubtless *N. mexicana* $\times$ *N. odorata*. Hardy.—*N. odorata sulphurea grandiflora* is a more recent and stronger-growing strain. G.L. 24:57.

14. $\times$ *tetragona* var. *hélvola* (*N. hélvola* or *N. pigmaea hélvola*). Lvs. floating, oval, 3–4 in. across, similar in shape to those of *N. tetragona*, blotched all over with brown; fls. floating, small, yellow, 2 in. across, open during the afternoon.—Probably *N. mexicana* $\times$ *N. tetragona*. Hardy.



2551. *Nymphaea elegans*. A blue Mexican water-lily.

15. *×* **Marliacea** var. **chromatella** (*N. chromatella*). Floating lvs. orbicular, much blotched with brown, 3-8 in. across; when crowded, the lvs. rise as much as 8 in. above the water, are dark green above, lighter beneath; petioles sometimes with longitudinal brown stripes; fls. bright yellow, 3-6 in. across; petals numerous, broad, concave; stamens deep yellow.—Probably *N. mexicana* *×* *N. alba* (or *N. tuberosa*).

Strong grower, free bloomer; a general favorite; perfectly hardy.

N. Moorei (*N. Mooreana*) is very similar to *N. chromatella*; believed to be *N. alba* *×* *N. mexicana*.—Probably as second or third hybrids of *N. mexicana* may be placed here Paul Hariot, clear yellow with delicate shadings of red at base of petals, and Sioux, rich brassy yellow, shaded red. Both have lvs. spotted reddish brown. They show some inheritance from *N. alba* var. *rubra* (see No. 28).

AA. Fls. white, rosy or red.
B. Rhizome erect; fls. white (*Chamænymphea*).

16. **tetragona**, Georgi (*C. tetragona*, Lawson. *N. pygmaea*, Ait.). Fig. 2553. Lvs. horseshoe-shape, entire, the lobes diverging, slightly produced and subacute, dark green above, inclined to brown blotching, reddish beneath, 3-4 in. across; fls. $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. across, open on 3 or 4 days from noon until 5 P.M.; base of fl. square; petals 13-17; stamens about 40, yellow. E. Siberia, China and Japan; also in N. Idaho and Ont. B.M. 1525. G.F. 9:134 (adapted in Fig. 2553).—The smallest nymphaea in cult.; free bloomer; makes no side-shoots from the single crown, but grows readily from seed. Seed next to the largest of the genus. *N. fennica*, Mela, is a form from Finland, and is offered by M. P. Andersen, Jönköping, Sweden. It runs into purple-fl. varieties.

Similar to *N. tetragona* and probably not botanically distinct. Requires cold water. *N. vomerense* is a small white water-lily, said to be *N. alba* *×* *N. tetragona*. *N. orientalis*, is a miniature plant with shining coppery green lvs. Japan. *N. himalayensis*, is smaller than the type. Himalayas.

BB. Rhizome horizontal, or, if not, fls. pink or red (*Eucastalia*).

C. Lvs. scattered loosely on the rhizome.

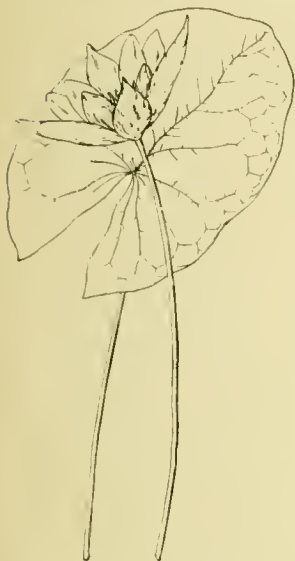
17. **odorata**, Ait. (*C. odorata*, Woodv. & Wood). SWEET-SCENTED WATER-LILY. Lvs. nearly orbicular, entire, somewhat coriaceous, dark green above, purplish red when young; under surface deep red to reddish green or almost pure green; diam. 5-10 in.; lobes usually diverging, but often touching or slightly overlapping; petioles greenish or brownish; fls. (in the type) white, 3-5 in. across, open 3 days from 6 A.M. till 12 M.; sepals green, tinged with reddish brown; petals 23-32, ovate to lance-ovate; stamens 55-113; yellow; outer filaments broad, white, petaloid; seed medium-sized. E. U. S., common. B.M. 819 (small). Gn. 4, p. 368; 55, p. 179. V. 2:196; 19:9.—Varies greatly in size and color, approaching *N. tuberosa*. Garden forms selected for size of fl. are called var. *superba* (*N. superba*, Hort.) and *N. lactea*.

18. Var. **minor**, Sims (*C. odorata* var. *minor*, Coek. *N. pumila*). Lvs. deep red beneath (or green when aerial); lobes diverging; diam. 2-5 in.; fls. white, $2\frac{1}{4}$ -3 $\frac{1}{4}$ in. across; sepals strongly purple-colored; petals 17-24; stamens 37-78. Same range as type; often a shy bloomer. B.M. 1652. A.G. 14: 112.—Sometimes grows where water recedes entirely in summer; usually in shallow water. N. Union is a garden form.

19. Var. **rosea**, Pursh (*C. odorata* var. *rosea*, Brit. Var. *rubra*, Hort.). CAPE COD WATER-LILY. Lvs. dark reddish on both sides when young, becoming green above; fls. pink, fading on the successive days of opening, 4 in. across. Cape Cod, Mass. B.M. 6708 (too pale). Var. *exquisita* is deeper in color of fl. and lf., and more easily grown. Vars. *rosacea*, *Jessica* and *Hermosa* are forms of var. *rosea*.

20. Var. **gigantea**, Tricker (*C. odorata* var. *gigantea*, Fern.). RICE-FIELD WATER-LILY. Lvs. large, 12-16 in. across, green beneath, at times tinged purplish toward margin; edge often turned up; petioles green; fls. 4-7 in. across, pure white; sepals green; petals 24-31; stamens 69-120. Del. to Fla., Mex., Cuba, Brit. Guiana.—In this may be included *N. odorata latifolia*, Harper, *N. eburnea*, *N. caroliniana nivea*, *N. gracillima alba*, and *N. Parkeriana*, Lehm.

21. *×* **caroliniana**, Hort. (*N. odorata caroliniana* or *carolinensis*. *N. odorata superba*, Rich. *N. tuberosa superba*). Lvs. entire, 12 in. across, sinus barely closed; green above, red beneath; fls. fragrant, 7 in. across; petals narrow, abundant, delicate rosy pink; rhizome stout.—Believed to be *N. odorata rosea* *×* *N. tuberosa*. The original type has given place to improved forms, such as *N. caroliniana perfecta*, *N. rosea*, and *N. salmonea* (*N. odorata perfecta* and *N. o. salmonea*), *N. odorata Luciana* (*N. Luciana*), *N. odorata suavissima* (*N. suavissima*), *N. odorata delicata*, *N. odorata turicensis*, and quite recently W. B. Shaw and Eugenia de Land. *N. Brakeleyi rosea* (*N. tuberosa rosea*) and *N. speciosa*.



2553. *Nymphaea tetragona*.
($\times\frac{1}{2}$)



2554. *Nymphaea tuberosa*.
($\times\frac{3}{4}$). No. 22.

belong here. *N. tuberosa* var. *rubra* of Sturtevant is a red form of this type, probably (*N. odorata rosea* × *N. tuberosa*) × *N. alba rubra*.

22. *tuberōsa*, Paine (*C. tuberōsa*, Greene. *N. reniformis*, Walt.). Figs. 2554, 2555. Distinguished from No. 47 chiefly by the numerous slenderly attached and spontaneously separating tubers, 1–3 in. long on the rhizome; lvs. when floating less coriaceous than in No. 17,



2555. Rootstock of *Nymphaea tuberosa*.

and more veiny above; petioles marked with longitudinal brown stripes; no purple or red color about lvs. or sepals; fls. 4–9 in. across, pure white, open 3 or 4 days from 8 A.M. to 1 P.M.; petals broad, concave; seeds large (.44 cm. long). N. Cent. U. S. G.F. 1:366 (adapted in Fig. 2555), 367; 6:416 (good). Gn. 21:130; 52, p. 441. B.M. 6536 (poor).—A luxuriant grower; when crowded or in shallow water the lvs. and fls. rise 4–6 in. above the water; spreads rapidly by tubers. Moderate bloomer. Garden forms are *N. tuberosa robusta* and Helen Fowler. Var. *Richardsōnii* (= var. *plena*) has many more petals than the type. R.B. 10:101. Var. *māxima* (*N. odorata maxima*, Hort.) is a form with round lvs. and closed sinus, the lobes curved out at the apex to a short point; petioles pubescent, with long hairs, with a few faint longitudinal brown stripes; fls. medium to large, pure white, somewhat cup-shaped. Lake Hopatkong, N. J.—Rather smaller than the type; possibly *N. tuberosa* × *N. odorata*. A diminutive form of *N. tuberosa* occurs near Trenton, N. J.

cc. Lvs. crowded on the rhizomes; European species and hybrids.

d. Foliage green or reddish, not spotted with brown.

23. *cāndida*, Presl (*N. biradiata*, Somm. *N. semiperta*, Klinggræf. *N. alba minor*, DC. *N. nitida*, Sims?). Similar to No. 24: line of insertion of the sepals angular, projecting downward; lowest pair of veins of lf. (veins of the lobes) curved toward one another: all of the filaments broader than their anthers; fr. ovoid; seed large. Cent. and N. Eu.

24. *ālba*, Presl (*C. alba*, Woodv. & Wood). Lvs. roundish, entire, floating, 4–12 in. across, red when very young; lowest pair of veins straight and diverging; rhizome black; fls. white (in the type), 4–5 in. across, open from 7 A.M. to 4 P.M.; petals broad, ovate, somewhat concave; angles of attachment of sepals rounded; filaments of innermost stamens not wider than the anthers; fr. more or less spherical; seed small. Eu. and N. Afr.—A robust species. In gardens, vars. called *Albatross*, *Harrisiana*, *Hermine*, *delicata* and *splēndens* may be found. Var. *candidissima* (var. *māxima*, var. *plenissima*) has lvs. orbicular, lobes strongly curved, overlapping, yellowish when very young; rhizome brownish, sometimes 3 in. through; fls. large, pure white, sterile.—The first nymphaea to bloom in spring, continuing until frost. Very robust; a most desirable white variety.

25. Var. *rūbra*, Lōnnr. (*C. alba rubra*, Lōnnr. *N. alba rosea*, Hartm. *N. alba purpurea*, Fries. *N. alba sphaerocarpa rubra*, Casp. *N. Casparyi*, Carr.). Outermost petals rosy, intermediate intensely rosy, innermost deep carmine-red; anthers and stigma yellow; filaments and styles orange to deep red-brown; variable in depth and purity of color, deepening on second and third days of flowering. Lake Fayer, Sweden. B.M. 6736 (stamens poor). R.H. 1879:230.—Difficult to grow, requiring cool water and subdued sunlight. About 15 named red water-lilies must be classed as

forms of this variety. Var. *Froebēlii* is the oldest of these and least adapted to cult. Jas. Brydon, *N. gloriōsa*, Wm. Falconer and *N. atropurpurea* are favorites. See also No. 27.

26. *ālba* × *odorata rosea*. Fls. large, cup-shaped, often raised above the water; petals broad, concave; lvs. large, dark green or purplish, rising above the water when crowded.—Robust, free-flowering plants, the color growing paler as the fl. ages; sterile. Three groups may be distinguished: (1) Fl. nearly white, flushed with rose; *N. Marliacca albida* (Gn. 78, p. 373), almost white; *N. Gladstoniana*, white; Goliath and *N. lusitana*, very large, rosy. (2) Fl. light pink; *N. Marliacca carnea*, flesh-color; Wm. Doogue, Mark Hanna, *N. eolōssa* (G. 34:609. G.M. 56:595). Leviathan, *N. somptuosa* are very large forms, and very satisfactory. (3) Fl. rose-color; *N. Marliacca rosea*, *N. nobilissima*, James Hudson.

DD. Foliage more or less flecked with brown.

E. Petals never tinted yellow; color deepening with age of fl.

27. *ālba rubra* × *tetragōna*. Rootstock usually erect and unbranched; lvs. small to medium size, dark green above with irregular brown spots; fls. small to medium size, pink or red.—Several garden forms, differing in size and color of fl., belong here: *N. Laydēkeri rosea*, fls. 2–3 in. across, pink changing to deep rose, opening about 11 A.M.; *N. Laydēkeri rosea prolifera*, a many-headed form. Of similar character, but larger in lf. and fl. (3–5 in. across) and colors from red to deep crimson are *N. Laydēkeri lilacea*, *N. L. fulgens*, *N. L. lucida*, *N. L. purpurea*, *N. L. rubra*, *N. Marliacca ignea*, *N. M. flammēa*, *N. M. rubra punctata*, *N. sanguinea*, *N. Ellisiana*, *Arethusa*, Jas. Gurney, Jas. Brydon, Wm. Falconer, Mrs. Richmond.

EE. Petals, especially the outer ones, more or less yellow.

28. *ālba rubra* × *mexicana*. Rhizomes erect; lvs. medium size (5–8 in.), brown-blotched; fls. 3–5 in. across, light yellow with pink center to orange, or red with yellowish tips and margins; the red color deepens



2556. *Nymphaea Lotus*.

Redrawn from the old figure in Botanical Magazine (1804), showing an historical picture of the true white Egyptian lotus.

as the fl. grows older. *N. Robinsanii* is recognized by a notch midway of the sinus of the lf. *N. Seignorēti*, *N. Andraena*, *N. aurora*, *N. chrysantha*, and *N. Laydēkeri filva* are the older members of this group. With larger fls. and clearer colors are the recent *N. Indiana*, *Comanche*, *Sioux*, *N. sulfatère*, *N. graziella*, *Phebus*, *Phoenix*, *Paul Hariot*. In this group may be placed *Are-en-ciel*, Jean Forestier, *N. formosa*, *N. puricea*.

SUBGENUS IV. LOTUS.

A. Fls. white.

29. *Lôtus*, Linn. (*C. Lôtus*, Woody. & Wood. *N. edulis*, DC. *N. thermâlis*, DC., of the hot springs of Hungary). WHITE LOTUS. Fig. 2556. Lvs. orbicular, dark green above, under surface brownish, smooth or slightly pubescent; diam. 12-20 in.: fl. white, the broad outer petals suffused pink, 5-10 in. across, open 7.30 P.M. to 11 A.M.; sepals pure green; petals concave, broad, 19 or 20; stamens 96-103, yellow; anthers shorter than the filaments. Egypt. B.M. 797. F.S. 7:706, 707. G.F. 2:173. J.H. III. 67:497.—To this species may be assigned the garden forms *N. thermâlis* with broad petals and cup-shaped fls. from the hot springs of Grosswardein, Hungary; and the probable hybrids *N. dentâto-lôtus*, *N. eastonensis* and Jubilee.

30. Var. *dentâta*, Schum. & Thonn. (*N. Ortgiesiana*, Planch.). Lvs. glabrous or somewhat puberulent beneath: fls. pure white, 8-10 in. across, open until 1 P.M.; petals narrower than in the type, ovate, opening out horizontal; anthers longer than the filaments. Cent. Afr., Sierra Leone. B.M. 4257. F.S. 627, 628. A.G. 15:366.—*N. dentâta grandiflora*, *N. d. magnifica*, and *N. d. superba* are large and floriferous forms.

31. *pubescens*, Willd. Lvs. ovate, 10-12 in. long, dark green above, dull purplish green and more or less pubescent beneath: fls. small to medium size, white; petals ovate, inner ones narrow; stamens inserted some distance above petals. India to Java and the Philippines.—Not cult.

32. *Zénkeri*, Gilg. Lvs. suborbicular, deeply triangular-excised, repand-dentate, thin and membranaceous, 5 in. across, pilose beneath: fls. $2\frac{1}{2}$ -3 in. across; petals 7-8, ovate-lanceolate, acute. Cameroon.—A very distinct dwarf form, cult. in Germany; probably not grown here.

AA. Fls. pink or red.

33. *rûbra*, Roxbg. Lvs. orbiculate, reddish brown, bronzy, becoming greenish, pubescent beneath, 12-18 in. across: fls. deep purplish red, 6-10 in. across, open 3 or 4 nights from 8 P.M. to 11 A.M.; sepals dull purplish red, 7-nerved, never opening more than 10° above horizontal; petals 12-20, narrowly oval, rounded at apex; stamens about 55, cinnabar-red in color, becoming brownish. India. B.M. 1280. F.S. 6:629. R.H. 1879, pp. 74, 75. P.M. 11:265.—This species varies much in color, and produces fertile hybrids with *N. Lotus* and *N. L. dentata*. There are, therefore, a series of garden forms of all colors from delicate pink to deep purplish crimson. In these the petals vary from broadly ovate and concave to narrowly ovate and flat, and the fls. are from tulip-shape to wide open. Some are highly floriferous, others shy bloomers. Most of these are arranged in order of color: fls. very delicate pink: *N. Smithiana*, petals broad; *N. india Isis*, *N. Laelia*, *N. L. colorans*. Fls. light pink: *N. delicatissima*, *N. Deaniâna*, more pink, petals broad; *N. Boucheana*, *N. india Spira*, *Reine d'Italie*. Fls. rosy pink: *N. kewensis* (C. L. A. 25, March, p. 35), *N. Micheliana*. Fls. red-pink: *N. Sturtevantii*, fl. tulip-shape, very massive; *N. rubicunda*, Hofgartner Graebner. Fls. magenta: *N. Omarâna*, fl. wide open, narrow petal; *N. Ortgiesiano-rûbra*, *N. Marie-Legrâncei*, *N. Bissittii*, Adele, Niobe, *N. tulipifera*, small, tulip-shape. Fls. rosy carmine: *Diana*, *N. india Brahma*, *N. rûbra rôsea* (B.M. 1364), *N. devoniensis* (B.M. 4665), Fig. 2557, *N. Arnoldiana*, Pres. Girard. Fls. carmine: *N. Krumbiegeltii*, *N. columbiâna*, *N. Diana grandiflora*. Fls. dark red: *N. purpurea*, Doetor Florence, Geo. Huster. Fls. crimson to deep purplish crimson: Frank Trelease, Rufus J. Lackland, James Gurney, Jr.

SUBGENUS V. HYDROCALLIS.

34. *amazônium*, Mart. & Zucc. Lvs. ovate, entire; lobes rounded; upper and lower surfaces spotted brownish or blackish, under surface reddish brown; petiole with a ring of long hairs at the point of joining the lf.: fls. 3-6 in. across, imperfectly open 1 or 2 nights; the bud opens about half and closes again between 3 and 6 A.M. the first night; the second night the sepals and outer row of petals open about 7 P.M., the other parts remaining as a tight, white bud until 3.30 A.M., when the fl. opens fully from 4.30-5 A.M., then closes by 6.30 A.M. and draws down into the water; petals usually 20; stamens 93-297. Trop. Amer. B.M. 4823.

35. *Rudgeana*, G. F. W. Mey. Lvs. elliptic to suborbicular, 18 in. long, margin coarsely and irregularly sinuate-dentate: fls. 3-6 in. across, imperfectly open 2 or 3 nights from twilight until dawn; usually only the sepals and 4, 8 or 12 outer petals open, the remaining parts forming a closed ovoid bud; occasionally a slight



2557. *Nymphaea devoniensis*. ($\times\frac{1}{2}$). Under No. 33.

aperture is formed by drawing apart of the tip of the bud, which occurs before midnight; petals usually 16-20; stamens 43-83. Trop. Amer.

36. *blânda*, G.F.W. Mey. (Not *N. blânda*, Planch., nor of gardens). Lvs. small, membranous, entire, suborbicular; lobes slightly produced, subacuminate and subhastate: fls. 4 in. across; habits of opening unknown; petals 16; stamens about 65. Trop. Amer.

In the Hydrocallis group are the following, known only in herbaria: *N. lasiophylla*, Mart. & Zucc. Bahia, Brazil; *N. Gardneriana*, Planch. S. Brazil; *N. Jamesoniâna*, Planch., Porto Rico and Ecuador; *N. stenaspidiata*, Casp., Goyaz, Brazil; *N. tenerinervia*, Casp. Bahia, Brazil; *N. oxyptala*, Planch., Ecuador; *N. Gibertii*, Morong, Paraguay.

Other nymphaeas occasionally met with are: *N. Baillii*, Rehn. & Henk., the smallest species known: fls. $\frac{3}{4}$ -1 in. across, white, slightly fragrant. S. W. Trop. Afr.—*N. eastonensis*=*N. Smithiana* $\times$ *N. O'Marana*.—*N. Henkeliana*, Rehn. & Henk. Fls. strikingly flat, pale blue, having an odor of violets. Austral.—*N. Maynardii*, Hort. "Fls. fully 9 in. across, of a lovely pale shade of heliotrope."—*N. virginidis*, Hort. Lvs. very large: fls. pure white, up to 11 in. across. Of garden origin.

HENRY S. CONARD.

NYMPHOIDES (*Nymphaea*-like). Syn. *Limnânthemum*. *Gentianaceæ*. FLOATING-HEART. Ornamental aquatic herbs.

Perennial, fibrous-rooted, stoloniferous or proliferous, with floating foliage: lvs. ovate or orbiculate, heart-shaped at the base, rarely peltate, with a closed sinus, entire or slightly wavy; peduncles with 1, 2 or many fls.; fls. white or yellow, in spring and summer, borne in the axils or on filiform sts. apparently from the petioles; corolla wheel-shaped, deeply 5-cut; lobes fringed or not; stamens 5, fixed at the base of the corolla.—Species about 20 in fresh water, in tropical and subtropical regions around the world and reaching into temperate parts. The generic name is in dispute, it having been known heretofore as *Limnânthemum*. This genus and a very few others are sometimes separated in the family Menyanthaceæ, distinguished from *Gentianaceæ* in habit, in alternate or basal lvs., and different æstivation.

The floating-hearts of cultivation are most useful ornamental aquatic plants, and are represented in cultivation by but four species. *Nymphoides lacunosum* is

hardest of American species; its mottled, variegated leaves, about 2 inches broad, are very attractive, regardless of its dainty, white, miniature flowers. It is best grown under natural conditions, in pools and still water, and in water about 2 feet deep. It may also be grown in tubs, as a surface covering, with a few tall plants in the center. *N. aquaticum*, commonly known as the fairy water-lily, is a much stronger grower: leaves deep green, and, when grown in natural ponds, attain large proportions, 4 to 6 inches broad, and bears innumerable flowers, more like flakes of snow. It is also valuable for tub culture, similar to the preceding species *N. indicum*, commonly called water snowflake, is undoubt-



2558. *Nyssa sylvatica*. ($\times \frac{1}{2}$)

edly the most interesting and attractive of any, and deserving of most general cultivation. The leaves are of a light green color, heart-shaped, and it produces flowers in greater abundance, which are much larger and covered completely with hirsute glands. These, as in the other species, are produced in clusters on the petioles, near the surface, and, although they are of but one day's duration, they are produced in such quantities that there is never any lack of these delicate flowers all through the season. In tub culture, this species will soon crowd itself over the edge of an ordinary tub, and, although the leaves no longer float on the surface, it does not affect the growth or the prolificness of its flowering. When grown in tubs, the receptacle should be filled two-thirds with moderately rich, loamy soil, covered with sand, and filled and kept filled with water. All three species, when strong enough to produce flowering leaves or petioles, send forth new shoots, as each cluster of flowers apparently terminates with a bud and produces leaves; these, when strong, produce flower-buds and leaf-buds again, and thus soon reproduce themselves. *N. aquaticum* produces a cluster of fleshy roots, with a bud from single leaves in fall, which are plentiful in Florida in the season. These are excellent for distribution, and can be sent safely a great distance. The petioles are very brittle and easily snap off, but the floating leaf soon emits roots at the broken end as well as where the flower-buds are located; thus it is very free and prolific. These are very desirable aquatic plants. The fourth species, *N. peltatum*, is a rampant, weedy plant, although its mottled foliage is beautiful and the flower is much larger than those of the above plants. Its habit of growth is also different; it produces runners, and rambles over an immense space; it also produces seed in great quantity, which, when ripe, floats on the surface for a short time, then sinks to the bottom; it is best confined to the limits of a tub, where it grows freely and produces its large yellow flowers in profusion. It is hard to eradicate when once established, as it is perfectly hardy. All the floating-hearts are very pretty and useful for tub culture, but after knowing the water-lilies the general public desires more bold and striking plants. (Win. Tricker)

A. Color of fls. yellow.

a. Fls. accompanied by clusters of tubers.

lacunòsum, Kuntze (*Limnánthemum lacunòsum*, Griseb. *Villarsia lacunòsa*, Vent.). Sts. sometimes 10 ft. long: lvs. orbicular-cordate, purplish beneath, 1-2 in. long: fls. 3-6 lines across; segms. ovate, acute: seeds smooth. July, Aug. Ponds, Nova Scotia to Fla. and La., west to Minn.

bb. Fls. not accompanied by clusters of tubers.

peltàtum, Brit. & Rend. (*N. nymphæoides*, Brit. *Limnánthemum nymphæoides*, Hoffm. & Link. *Menyanthes nymphæoides*, Linn.). Plant stout and branching: lvs. 2-4 in. broad: fls. 1 in. across or more; segms. obcordate, short-fringed. May-July. Eu., Asia; naturalized in District of Columbia.—Simulates *Limncharis Humboldtii* in habit.

AA. Color of fls. white (varying to yellow in the last).

B. Seeds rough.

aquaticum, Kuntze (*L. trachyspermum*, Gray. *Villarsia aquatica*, Gmel.). Stouter and larger than *N. lacunosum*: lvs. cordate orbicular, thick, entire or repand, 2-6 in. long, spongy; tubers thick: fls. 6-10 lines broad. April-July. N. J. to Fla. and Texas.

BB. Seeds smooth.

indicum, Kuntze (*L. indicum*, Thwaites. *Menyanthes indica*, Linn.). WATER SNOWFLAKE. Fls. white, yellow toward the base within; segms. fimbriated, densely papillose, without a longitudinal fold down the middle. Tropics. Gn. 1 4:182.—There is said to be a rich yellow variety.

WILHELM MILLER.
L. H. B.†

NYSSA (name of a water nymph; these trees grow in swamps). *Nyssææ*, formerly included in *Cornæcæ*. TUPELO. PEPPERIDGE. SOUR GUM. Ornamental trees planted chiefly for their handsome foliage and brilliant autumnal tints.

Deciduous: lvs. alternate, petioled, entire or rarely remotely toothed, stipulate: fls. polygamo-dioecious, minute, greenish white, in slender peduncled clusters; the staminate fls. slender-pedicelled in many-fl. clusters; calyx cup-shaped, 5-toothed; petals 5, imbricate, inserted on the margin of the conspicuous disk; stamens 5, exserted; ovary 0; pistillate fls. sessile, 1 or 2, or in few-fl. clusters; calyx-tube campanulate, 5-toothed, petals small; stamens 5-10, short, anthers often sterile; ovary 1-2-celled; style slender, recurved; fr. an oblong drupe, usually 1-seeded, with a bony, ridged or winged stone.—Five species in N. Amer. and 2 in Asia.

The tupelos are bold and picturesque trees with medium-sized or rather large, generally obovate or oblong lustrous leaves, insignificant greenish white flowers in slender-stalked clusters or solitary, and conspicuous, blue, red or purple oblong solitary or paired fruits. They are chiefly valued for the flaming scarlet of their autumn foliage and for the distinctness of their winter aspect. *N. sylvatica* is hardy North, while the other species are tenderer. They grow in swamps and are usually 40 to 60 feet high, attaining a maximum of 100 feet. Old specimens often have a melancholy appearance by reason of the drooping habit of the lower limbs. The upper branches of a tupelo are often twiggy, crooked or "kinky." Tupelos are hard to transplant from the wild, even when heavily pruned, because they have remarkably long roots with few rootlets. Nursery-grown trees that have been frequently transplanted are preferable. Propagation is by seeds sown at once or stratified; if allowed to become dry, they do not germinate until the second year; sometimes increased by layers which, however, root slowly.

sylvatica, Marsh. (*N. multiflora*, Wang.). TUPELO. PEPPERIDGE. BLACK GUM. SOUR GUM. Figs. 2558,

2559. Tree, to 100 ft., with slender pendulous branches forming a flat-topped usually cylindrical head, sometimes low and broad, or in crowded trees pyramidal: lvs. usually entire, obovate or oval, mostly acute or acuminate, lustrous above, pubescent on the veins or glabrous at maturity beneath, 2-4 in. long: staminate fls. in compound heads; pistillates larger, 2 or several: fr. $\frac{1}{3}$ - $\frac{2}{3}$ in. long, nearly black, acid, with an ovoid stone, little flattened. Maine and Ont. to Mich., to Fla. and Texas. G.F. 3:491; 7:275. F.E. 14, pl. 32. S.S. 5:217.

aquatica, Marsh. (*N. uniflora*, Wang. *N. denticulata*, Ait.). CORRON GUM. Tree, occasionally to 100 ft.,

with small spreading branches forming a pyramidal head: lvs. slender-stalked, ovate to oblong, acute or acuminate, entire or remotely toothed, at maturity lustrous above, pubescent beneath, 5-7 in. long: pistillate fls. solitary, surrounded by 2-4 strap-shaped bractlets to $\frac{1}{2}$ in. long: fr. oblong, 1 in. long, dark purple. Va. to Ill. and Texas. S. S. 5:220.

N. sinensis, Oliver. Tree, to 40 ft.: branchlets pubescent: lvs. elliptic, dull dark green above, light green and pubescent on the veins beneath, 4-6 in. long: pistillate fls. few, on slender stalk: fr. oblong, bluish, $\frac{1}{2}$ in. long. Cent. China. H.F. 20:1964.—Has proved hardy in S. England.

WILHELM MILLER.
ALFRED REHDER.†



2559. Pepperidge.—*Nyssa sylvatica*.

OAK. Plants of the genus *Quercus* (which see). The word is also applied to other plants to some extent, from resemblances in form of tree, in leaf, or in hardness of wood. In Australia, where there are no species of *Quercus*, the word oak is applied to the species of *Casuarina*, "from a fancied resemblance," as Maiden says, "of the wood of casuarinas to that of oak." Other plants in Australia are sometimes known as oaks. The silk oak of florists is *Grevillea robusta*. The Jerusalem oak is *Chenopodium Botrys*, probably from the shape of the leaves. Poison oak is *Rhus Toxicodendron*, and related species.

OAKËSIA (Wm. Oakes, New England botanist, 1799-1848). *Liliacæ*. Three species of native perennial woods herbs, having the graceful habit of such choice wild flowers as the Solomon's seal and more particularly the common bell-wort, *Uvularia perfoliata*. *O. sessilifolia* has been offered by a few dealers in hardy plants. It prefers a rich light soil in a rather moist, partially shaded position, and improves under cultivation.

Oakesia can be easily distinguished from *Uvularia* by the lvs., which are merely sessile instead of perfoliate, by the angled rather than terete sts., and fls. opposite the lvs. rather than terminal. Oakesia was separated from *Uvularia* in 1879 by Watson. Lately the name Oakesiella has been applied to the genus because there is an earlier Oakesia (which, however, is an untenable name for *Corena*). By some botanists, the species are still retained in *Uvularia*. Other generic characters are: fls. few, solitary on short pedicels opposite the lvs.; segments without callosities; caps. membranous, elliptical, winged, acutish at each end, very tardily dehiscent; lvs. more or less rough on the margins; seeds globose, with a tumid raphe but no aril.

sessilifolia, Wats. (*Uvularia sessilifolia*, Linn. *Oakesiella sessilifolia*, Small). St. once forked; lvs. oblong-lanceolate, acute at each end; margins minutely sca-

brous; caps. borne on a distinct stipe. Canada to Fla. and Ark. B.M. 1402. L.B.C. 13:1262. L. H. B.†

OAT: *Avena sativa*.

OBELISCARIA: *Lepachys*.

OBERONIA (Oberon, king of the fairies, because of the quaint flower forms). *Orchidacæ*. Perhaps 100 tufted epiphytic orchids in Trop. Asia and Austral. and Pacific islands, little known in cult., but of much botanical interest. Lvs. distichous, ensiform or terete; fls. very small, in dense spikes or racemes, in the cult. species yellow, orange or buff; sepals free, equal or nearly so, oblong or broadly ovate, larger than the petals; lip sessile, usually concave, entire or toothed.

They probably require warm-house treatment; some of them will grow on blocks. None of the species seems to be regularly in the trade here, but odd or particular plants are sometimes offered, as *O. tahitensis*, Lindl. (*O. iridifolia*, B.M. 4517, not Lindl.), *O. Myosurus*, Lindl., *O. ensiformis*, Lindl. (*O. acutis*, Hook. B.M. 5056).

ÓCHNA (old Greek name for a wild pear, which some of these plants were thought to resemble in foliage). *Ochnacæ*. Glasshouse woody plants, little grown for the odd showy bloom and fruit.

Ochna is a genus of about

25-30 species of trees and shrubs of Trop. Asia and Afr., and a few in S. Afr.: lvs. deciduous, alternate, minutely serrate, leathery, shining; fls. yellow, rarely greenish, jointed to the pedicels; sepals 5, colored, imbricate, persistent; petals 5-10; stamens indefinite; anthers opening longitudinally or by pore-like slits; ovary deeply 3-10-lobed, the lobes 1-celled, 1-ovuled, and seated around a central disk or receptacle and becoming sessile drupes, styles connate.

multiflora, DC. Glabrous shrub, 4-5 ft. or more high; lvs. oblong-elliptical to oblanceolate-oblong; petals sessile; anthers as long as the filaments, opening longitudinally, sepals in fr. about 4 lines long. Upper



2560. The white oak.—*Quercus alba*.

Guinea. G.C. III. 40:212. J.H. III. 44:209. G.W. 2, p. 328—*O. multiflora* is a greenhouse shrub cult. by a few fanciers for its remarkable appearance when in fr. The fls. are yellow, appear in spring, and are borne to the number of 10–15 in racemes terminating short lateral branches. The blossoms are short-lived, but the calyx is persistent. Its 5 sepals are greenish in fl., but become a bright red in fr. The receptacle increases until it becomes an inch or so thick, globular and bright red. Upon it are borne black seedlike bodies, which are the carpels. The red and black make a fine contrast. This plant is best prop. by half-ripened cuttings struck in summer or autumn. It requires in England a winter temperature of 48–60°, and summer temperature of 60–85°; soil, fibrous loam with plenty of drainage.

O. atropurpurea, DC., of the Cape, may occur now and then: shrub, 4–5 ft., with ovate denticulate lvs.; calyx dark purple, petals yellow; fls. on 1-flid. stalks. J.F. 1:29.

WILHELM MILLER.
L. H. B.†

OCHROCÁRPOS (Greek, *yellow fruit*). Incl. *Caly-siccion*. *Guttiferae*. Trees, of about 20 species, widespread in the tropics, little known horticulturally. Lvs. opposite or in 3's, coriaceous; fls. axillary, polygamous, the petals 4–7 or more; stamens indefinite, free or somewhat connate, the filaments slender and anthers erect; ovary 2-celled; fr. berry-like, with a few large seeds. *O. africanus*, Oliver, is a tree 40–50 ft. high; lvs. large, oblong-elliptical, with the midrib very prominent beneath; fls. from the nodes of the fallen lvs., 1½ in. diam., the petals half as long again as sepals; stamens very many; fr. very large, several inches diam., with yellow pulp. Upper Guinea. *O. obovatis*, Safford, is the 'chopag' of Guam, the wood of which is used in house-construction (p. 1699, Vol. III). It is a medium-sized tree, with opposite short-petioled obovate or oblong-obovate entire lvs. rounded at the apex, and fragrant white polygamous fls. borne laterally, single or clustered.

L. H. B.

OCHRÔMA (named for the *pale*ness of the fls.). *Bombacaceae*. One tree of Trop. Amer., allied to Ceiba: lvs. simple, angled or lobed; fls. large, terminal. *O. Lagopus*, Swartz, is listed abroad but hardly a horticultural subject: it is the corkwood or balsa of the W. Indies, from which canoes and other things are made, the wood being very light, the bark yielding fiber: tree to 40 ft. high; lvs. 5–7-lobed or only angular, nearly entire or dentate, puberulous beneath; petals 5–6 in. long, yellowish white or brownish, somewhat surpassing the column of stamens, obovate and wavy, clawed; calyx 5-lobed, subtended by a caducous involucre of 3 parts; stamens comprising a column which is topped by 1-celled anthers; stigma 5, exserted, spiral; caps. 1 in. long, 5-celled, with reddish brown wool inside.

L. H. B.

OCHRÔSIA (name records the pale yellow color of the fls.). *Apocynaceae*. Fifteen or more trees, extending from the Mascarene Isls. eastward to Hawaii, little known to cult.: lvs. scattered, whorled or opposite, with numerous nerves, coriaceous, entire, often large; fls. in peduncled cymes, of medium size, often very fragrant, mostly white, yellowish or cream-colored; calyx small, glandless, deeply 5-cleft; corolla salverform, the tube cylindrical and dilated at point of insertion of stamens, the throat constricted and glabrous; disk small or wanting; carpels 2, distinct or connate at base, ripening into spreading few-seeded or 1-seeded drupes.—The species are grown somewhat in tropical countries for the ornamental foliage and frs.

O. borbonica, Gmel., is an evergreen tree 20–30 ft., with stout branches, glabrous; lvs. large, whorled, obovate, narrowed to a petiole, rounded at apex, shining above; fls. white; corolla-limb ½ in. diam.; drupes about 2 in. long, bright red, considered to be poisonous. Mascarene Isls. eastward.—*O. elliptica*, Labill.—*O. parviflora*.—*O. purciflora*, Hemsl. (*Cerbera parviflora*, Forst.), is

a Pacific species, somewhat planted in Hawaii: 30–40 ft., evergreen, with rough bark and cylindrical twigs; lvs. ternate quaternate, crowded at ends of branches, oblong-lanceolate, acuminate, shining; fls. small, white; fr. 1 or 2 scarlet drupes, not edible.—*O. sandwicensis*, Gray, of Hawaii, is a small tree or large shrub, 10–25 ft., with long drooping branches; lvs. in 3's or 4's, long-oblong, short-acuminate, shining above; fls. yellowish to cream-colored; drupes dry, yellowish at maturity, not edible.

L. H. B.

ÖCIMUM (an old Greek name). Sometimes spelled *Ocymum*. *Labiatae*. Sweet herbs. See *Basil*.

Annual and perennial, sometimes shrubby, with opposite lvs.: fls. mostly small and white or whitish, or yellow, usually 6 in each verticil and the verticils in terminal or panicleate racemes; calyx deflexed in fr., unequal-toothed; corolla-tube usually not exceeding the calyx, 2-lipped, the upper lip 4-lobed; stamens 4, didynamous and declined; style shortly 2-cut; nutlets ovoid or subglobose, smooth or punctate.—Species about 60, in the warmer parts of the world. Little known in cult. except in the basil, which is used as seasoning and also grown for its very pleasing fragrance. This is *O. Basilicum*, Linn., of Trop. Asia and Afr. and Pacific islands: annual, glabrous or slightly pubescent, much branched, 1–2 ft. high; lvs. petioled, ovate, entire or toothed; fls. in moderately dense racemes, white or more or less tinged purple; calyx becoming ¼ in. long, and corolla ½–1 in. long; stamens slightly exserted. *O. minimum*, Linn., the bush basil, is probably a small cult. form of the foregoing. *O. suave*, Willd. (*O. gratissimum* var. *suave*, Hook.), the tree basil of India, Afr., and the E., is a shrub 4–8 ft. high, woody below and much branched, the lvs. densely soft-tomentose on both surfaces and in this differing from *O. gratissimum*: lvs. ovate, acute, crenate or coarse-toothed; corolla whitish or purple-tinged, little exceeding the calyx, the latter becoming ¼ in. long; racemes dense and much panicled, becoming 6–9 in. long.

Of the common basil (*O. Basilicum*) are forms of compact habit, and others with purplish foliage; also with crimped or wavy lvs. The basils are tender and should not be trusted in the open ground until unsettled weather is passed. The plants may be started indoors, and transplanted to 6–10 in. apart in warm ground. The herbage is cut when the plant is growing, and dried in bundles; the plant, when cut off, gives a new crop if it is not exhausted and if the soil is good. Roots may be lifted for a winter supply of foliage. The very aromatic herbage is used for seasoning, and the plant was once esteemed for medicinal properties. The oil is used in the preparation of certain liquors. L. H. B.

OCTOMÈRIA (from the Greek for *eight* and *part*, referring to the pollinia). *Orchidaceae*. Epiphytic herbs: sts. caespitose; lf. solitary, sessile or subsessile, borne at the tips of the sts.; fls. small, clustered at the base of the lvs.; sepals and petals similar, spreading; labellum shorter than the sepals, strongly 3-lobed or pandurate; column short; pollinia 8.—The following species are natives of Brazil.

arcuata, Rolfe. Sts. somewhat slender, clothed with membranaceous sheaths; lvs. subsessile, brown-purple on both sides when mature, lanceolate, sub-recurved, fleshy; fls. bright yellow, solitary, sub-pendulous; sepals and petals oblong, obtuse; labellum recurved, lateral lobes erect, obtuse, middle lobe broadly triangular-ovate, disk bicarinate, keels and side lobes dark purple.

decipiens, Dammer. Sts. 2–3-jointed, terete, clothed with membranaceous sheaths; lf. semi-terete; fls. fasciculate, shortly pedicellate; sepals and petals ovate, the lateral sepals slightly connate at base, yellow; labellum triangular-ovate, elongated, 3-lobed; lateral lobes rounded, erect; middle lobe yellow, disk bilamellate.

Öppenheimii, Dammer. Sts. about 2 in. long; lf. ovate-lanceolate; fls. white; lateral sepals connate at base, lanceolate, acute; upper sepal lanceolate, acu-

mmate; petals lanceolate, labellum lyrate, 3-lobed, fleshy at base, otherwise hyaline, margin irregularly denticulate, disk bicarinate. OAKES AMES.

ODONTADÈNIA (Greek, *toothed glands*). *Apocynacea*. Here belongs the tropical yellow-flowered climber sold as *Dipladenia Harrisii*, which rivals in beauty the well-known greenhouse allamandas.

Tall shrubby climbers or lianas; lvs. opposite; cymes loose, usually ample, rarely few-fl'd. and scarcely branched; calyx 5-parted, the lobes remarkably blunt or rounded; corolla-lobes twisted in the pointed bud, overlapping to the right and twisted to the left; stamens fixed at the top of the narrow part of the tube; fls. yellow, whereas those of *Dipladenia* are yellow only in throat if at all. The genus is further distinguished from *Dipladenia* by the shape of the calyx-lobes and by the cup-shaped group of toothed glands below the pistil.—Species 20–25, Trop. S. Amer. and Cent. Amer.

grandiflora, Schum. (*O. speciosa*, Benth. *Dipladenia Harrisii*, Hook.). Shrubby branched climber: largest lvs. 10–15 x 4–5 in., oblong, tapering, scarcely leathery, feather-veined, often purplish beneath; petioles stout, scarcely 1 in. long; racemes axillary and terminal; pedicels red, often 1 in. long, curved downward; corolla-tube with a roundish base about ½ in. long and thick, then suddenly constricted, then gradually widening into a funnel-shaped fl. Brazil, Guiana, Trinidad. B.M. 4825.—The fls. are fragrant, about 3 in. across, funnel-shaped, with 5 rounded, spreading lobes, and are more or less streaked with red in the throat, at the base of the lobes, and on the back of the tube. The treatment for dipladenias (see *Dipladenia*, Vol. II) should be attempted for *Odontadenia*, but *O. grandiflora* perhaps grows at lower altitudes, and may require the treatment usually given to hothouse vines.

O. nitida, Muell. Arg. (*O. cordata*, A. DC.) from Trop. S. Amer., is a twining glabrous shrub with yellow corolla bearing a band of vermilion below the middle of the narrow tube; fls. oblong or elliptic, 1–6 in. long; fls. nodding on axillary pedicels, the tube narrow and constricted at the colored part, the 5 lobes broad-ovate and acute. It is referred to the genus *Angadenia* in B.M. 8233 (*A. nitida*, Miers), and is probably best understood when thus separated.

WILHELM MILLER.

L. II. B.†

ODONTIÒDA (compounded from *Odontoglossum* and *Cochlioda*) *Orchidaceæ*. A genus established to contain the hybrids between *Odontoglossum* and *Cochlioda*.

The following are some of these hybrids: *O. beechense* = *O. Rolfeæ* × *C. Noetzliana*.—*O. Bônhôffæ* (*O. cirrhosum* × *C. vulcanica*). Fls. blood-red, the sepals and petals narrow, marked somewhat with white, tinged slightly purple at base; lip with a yellow crest with a few red spots.—*O. Boltonii* = *O. Vuylstekeæ* × *C. Noetzliana*.—*O. Bradshawæ* (*O. crispum* × *C. Noetzliana*). Fls. resembling in shape those of the first parent, but smaller; sepals and petals cinnabar-scarlet; lip 3-lobed, whitish, the lobes scarlet-tipped, and a spot of the same color in front of the yellow crest. Gn. 71, p. 55. G.M. 56:337.—*O. Brèwii* = *O. Harryanum* × *C. Charlesworthii*.—*O. Charlesworthii* (*O. Harryanum* × *C. Noetzliana*). Fls. resembling in shape those of the cochlioda, ruby-crimson, except the spiny yellow crest. Gn. 72, p. 301. J.H. III. 56:583.—*O. chelsiensis* (*O. crispum* × *C. vulcanica*). Fls. intermediate in shape between those of the parents, compactly arranged, carmine-rose, lightly marbled with yellow on the sepals; lip light yellow, 3-lobed, the lobes tipped with carmine-rose, and a darker blotch in front of the crest. O.R. 17:48. G.M. 52:70. Gn. 73, p. 112.—*O. chesingtonensis* = *O. Rolfeæ* × *C. Noetzliana*.—*O. Cooksoniæ* = *O. ardentissimum* × *C. Noetzliana*. O. 1913, p. 193.—*O. Corneyana* = *O. Lambeauianum* × *C. Noetzliana*.—*O. Craveniana* (*O. cordatum* × *C. Noetzliana*). Fls. more nearly resembling in shape those of the cochlioda; sepals and petals red; lip broad, salmon-red, white in front, and with a yellow

crest. G.M. 51:25.—*O. cùprea* = *O. cristatum* × *C. Noetzliana*.—*O. daltonensis* = *O. Phœbe* × *C. Noetzliana*.—*O. Devossiana* (*O. Edwardii* × *C. Noetzliana*). Panicle compact; fls. crimson, the 3-lobed lip lighter at the apex, and with a yellow crest. O.R. 16:41.—*O. eboracum* (origin doubtful). Fls. medium-sized, scarlet; lip with pale yellow markings.—*O. Flôryi* = *O. Andersonianum* × *C. Noetzliana*.—*O. galtonensis* = *O. Kegeljanii* × *C. Noetzliana*.—*O. Godsoniæ* (origin doubtful). Fls. large, rosy red, irregularly marked with cream-color; crest of lip yellow, somewhat red-marked in front. G.C. III. 45:195. G.M. 53:302.—*O. Graireana* = *O. Rossii majus* × *C. Noetzliana*.—*O. grata* = *O. tripudians* × *C. Noetzliana*.—*O. heatonensis* (*O. cirrhosum* × *C. sanguinea*). Fls. white, the sepals and petals oblong-lanceolate, suffused at the apex and spotted below with rosy purple; lip ovate, spreading, acuminate and recurved at the rosy purple apex. B.M. 8133.—*O. Hemptincana* = *O. eximium* × *C. Noetzliana*.—*O. Hyeana* = *O. ardentissimum* × *C. Noetzliana*.—*O. ignea* = *O. Lindenii* × *C. Noetzliana*.—*O. Jéssopiæ* = *O. "Queen Alexandra"* × *C. Noetzliana*.—*O. keighleyensis* = *O. cirrhosum* × *C. Noetzliana*.—*O. Lambeauiana* = *O. Lambeauianum* × *C. Noetzliana*.—*O. Lecana* = *O. spectabile* × *C. Noetzliana*.—*O. Lulëtia* = *O. luteo-purpureum* × *C. Noetzliana*.—*O. maculatissima* = *O. amœnum* × *C. sanguinea*.—*O. Môssiæ* = *O. maculatum* × *C. Noetzliana*.—*O. nevêse* = *O. nevadense* × *C. Noetzliana*.—*O. oakwoodiënsis* = *Odontioda Bradshawæ* × *O. percultum*.—*O. rawdonensis* = *O. ardentissimum* × *Odontioda Charlesworthii*.—*O. Rôlfei* = *O. Hunnewellianum* × *C. vulcanica*.—*O. roscifieldiënsis* (*O. triumphans* Mr. de B. Crawshay × *C. Noetzliana*). Fls. scarlet, slightly shaded yellow; lip yellow, red-tinged, the basal ridges bright yellow. G.C. III. 49:308.—*O. Sanderæ* = *O. percultum* × *C. Noetzliana*.—*O. Schrâderi* = *O. crispum* × *Odontioda Bradshawæ*.—*O. Seymouræ* = *Odontioda Charlesworthii* × *Odontioda Bradshawæ*.—*O. Seymouriæ* = *O. Uroskinneri* × *C. vulcanica*.—*O. speciosa* = (?)—*O. Thwaitesii* (*O. Harryanum* × *C. vulcanica*). Sepals and petals bronzy claret; lip lilac-purple with a yellow crest. J.H. III. 57:147.—*O. Vuylstekeæ* (*O. nobile* × *C. Noetzliana*). Fls. about 2½ in. across; sepals and petals ovate-lanceolate, with a crimson base, the upper portion white with red spots, the margin pink; lip fiddle-shaped, yellow at base, the rounded lateral lobes crimson, the rounded middle lobe white, crimson-spotted. B.M. 7990. R.B. 33:169. Gn. 65, p. 433.—*O. wickhamensis* = *O. crispum* × *C. sanguinea*.—*O. Wilsonii* = *O. Pescatorei* × *C. vulcanica*.—*O. Zenobia*. G.C. III. 55:226.

GEORGE V. NASH.

ODONTOCÍDIUM (compounded from *Odontoglossum* and *Oncidium*). *Orchidaceæ*. A genus established to contain the hybrids between *Odontoglossum* and *Oncidium*.

O. Edwardatum = *Odontoglossum Edwardii* × *Oncidium serratum*.—*O. Fowlerianum* = *Odontoglossum cirrhosum* × *Oncidium Forbesii*. G.M. 54:878.

ODONTOGLÓSSUM (Greek, *tooth-tongue*; in allusion to the crest on the labellum). *Orchidaceæ*. Orchids which on account of their handsome flowers are great favorites of cultivators. *O. crispum* is one of the finest of all orchids.

Plants epiphytic, with short rhizomes and 2-lvd. pseudobulbs, often with sheathing lvs. at the base: fls. in few- to many-fl'd. racemes or panicles arising from the base of the pseudobulb; sepals and petals spreading, free, or the lateral sepals rarely somewhat united at the base; base of the labellum ascending parallel to the column and sometimes adnate to the latter; lateral lobes small, often erect; middle lobe large, spreading, variously shaped; column clavate, narrowed at the base, longer than in *Oncidium*.—About 100 species,



LXXVI. *Odontoglossum crispum*, with *Asparagus Sprengeri* decoration.

natives of the higher regions of the Andes from Mexico and Guatemala to Colombia, Bolivia and Peru.

This genus is closely related to *Oncidium* and *Miltonia*, some of the species of the latter being generally cultivated as odontoglossums. These two genera are easily distinguished from *Odontoglossum* by the labelum, which expands directly from the base of the column. There is perhaps no genus of orchids in which the species are more variable and more closely related than in *Odontoglossum*. Numerous varieties connect the species by intermediate links, and the occurrence of many natural hybrids makes the limitation of species in this genus almost impossible. However much this may add to the perplexity of the botanist, it gives the genus an additional horticultural value and interest resulting in the production of numerous garden hybrids and in the selection of many varieties, one species, *O. crispum*, having over a hundred named kinds.

Cultivation of odontoglossums.

Odontoglossums follow the high western mountain ranges from southern Mexico to southern Peru, and usually grow at great altitudes. With few exceptions, they are found in extremely moist situations where the annual rainfall is excessive and the temperature more or less even and cool throughout the year.

The extreme heat of our summer interferes somewhat with the culture of odontoglossums in America, especially those of the *O. crispum* section, and it is necessary to use every precaution during that season to insure success.

A lean-to or half-span roof structure of northern exposure, protected by a brick or stone wall on the south side, and with ample means of ventilation, is best suited to odontoglossum culture. Moreover, it should be provided with rolling shades elevated on framework 18 or 20 inches above the glass, to afford abundance of light, free access of air and requisite shade, with the additional assistance of keeping down the temperature in summer. The interior is best fitted with solid beds, if possible, but benches of stone flags or wood covered with ashes or gravel an inch or two deep will answer very well. These, with the floors, should be hosed down two or three times daily, to keep the house as cool and as moist as possible.

Ventilation is highly essential at all times, especially in dull or wet weather. When the atmosphere is overcharged with moisture, the quantity must be governed by outside conditions. Top ventilation is most satisfactory, because it allows the heated air to escape, gives less direct draft on the plants, and does not have the drying effect produced by side currents.

The temperature during winter should never rise above 65° F., even with mild sun heat, and may fall to 48° or 50° at night, or even lower, without injury; during summer it must be kept as low as the outside temperature will admit. Fire heat should be dispensed with as early as possible in spring.

Odontoglossums do well under pot culture, excepting a few, such as *O. Londestroughianum* and *O. brevifolium*, with long creeping rhizomes; *O. citrosimum*, which has pendulous flower-scapes, and some of the smaller-growing species, such as the *O. Rossii* section, which are more easily cared for under basket culture.

Repotting should be attended to in October and November, never during the summer months. Chopped fibrous peat, live sphagnum and clean decayed leaves in equal quantity, well mixed together, afford a very satisfactory compost. About one-half of the pot space should be devoted to drainage of charcoal or broken potsherds. The plants should be firmly potted, leaving the surface slightly convex, thus elevating the base of the plant a little above the rim of the pot when finished.

The *O. crispum* section, which includes *O. Coradinei*, *O. gloriosum*, *O. cirrhosum*, *O. luteo-purpureum*, *O.*

nobile, and kindred species, requires an abundance of water at all seasons; in fact, the compost should never dry out, and judicious light overhead syringing once a day is beneficial in bright weather, but on very warm days it should be applied in the evening, at the same time allowing free ventilation to ensure good atmospheric action. Weak liquid cow-manure during the flowering period is also of assistance.

Species of the *O. grande* section do not require so much water at the roots as the *O. crispum* type; the compost should be allowed to dry out frequently. They are also benefited by a little sun during winter. *O. citrosimum* is an exception to the genus as regards temperature, and should be grown 10° warmer. It does very well in the cattleya department, enjoys a good supply of water at the roots at all seasons, and may be easily induced to flower freely by giving it a sunny location during winter.

Very few of the species can be satisfactorily propagated by division; the trade depends principally on fresh importation, and they come readily from seeds. (See the article on *Orchids*, beginning page 2380, for discussing of seed-growing methods of orchids in general.)

Among the worst enemies of odontoglossums are slugs and the small shell snails. They destroy the tender flower-scapes, often attacking them even in the leaf-sheath. A piece of cotton wrapped about the base of the pseudobulb will afford a means of protection, and many may be caught by distributing bits of apple, potato, or saucers containing dry bran freely among the plants. Look them over in the morning or evening with a lantern.

ROBERT M. GREY.

Cool odontoglossums.

There has been a large measure of success attained in the culture of these Andean plants in several instances and near the seashore, or during a cool summer season. The plants do well under special conditions, such as a structure facing north, with ample shade by using roller-blinds a foot or more above the glass roof, and by using a spray of water on very hot days either under the benches or in the path, ejected with force to create a spray and cause rapid evaporation. Perforated pipes have been used, but these soon clog up and are ineffectual. It is best to turn off the spray at night as the outside air will be cooler. It is best in winter to bring the plants to a lighter house where they can get all the sun in the dull months, as most of the growth is made during the winter and needs to be well matured and strong to carry the plants through the flowering period of early summer months. In March, there are very bright days when a little shade is necessary, and early in April removal should be made to summer quarters in the coolhouse proper. One very hot summer has been known to undo the upbuilding of several preceding cool ones. Odontoglossums are freely raised from seeds by the hybridist in Europe, but have never been raised in the American collections. Their seeds germinate the readiest of any orchids, coming up like grass in a few weeks after sowing, but invariably go down again during the heat of "dog days" in summer. The hybrids imported seem to have more vigor, especially those that have *O. nobile* as a parent. One of the most wonderful phases of the hybridists' work is seen in the great variety produced, the proving up of the origin of many supposed species of Reichenbach and others, the reproduction of fine types from seeds true to themselves in a measure, but usually with an admixture of the poorest present, showing the very complex origin of our most beautiful garden orchids as they were found first. The partial extinction of these odontoglossums by the march of cultivation of coffee and other valuable crops in the Andes has no longer any terror to the cultivator, equally good forms now being raised in gardens, and sometimes flowered in months rather than years. There is still the element of uncertainty as to what will

appear, as with the native imported pieces. Even the once rare native natural hybrids are now produced, but from the finest types as parents, and sold now at modest prices. It is too much to expect that the cultivation of *O. crispum* and other coolhouse species will become general until there is certainty of control of temperatures in summer as in winter. Good results have been gained by giving a weak solution of ammonium phosphate, two ounces potassium nitrate, three ounces to three gallons of water, using one ounce of this stock solution to each gallon used for the plants. This is known as the "Cookson formula," advocated by a cultivator who noticed that odontoglossums flourished in the vicinity of smoky cities, and it was traced to the deposit of soot on the glass roofs carried by rain-water into the cisterns to be used for the plants. Rain-water is seldom conserved here for watering orchids, but the addition of this slight quantity of fertilizer seems to be beneficial and to take the place of the rain-water.

E. O. ORPET.

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AAA. Fls. dark purple.	
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SECTION I.

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AA. Labellum oblong or fan-shaped, shorter than the sepals; apex rounded, emarginate, or acute; margin entire.	
B. Apex rounded or emarginate.	
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	14. <i>odoratum</i>

1. *Londesboroughianum*, Reichb. f. Pseudobulbs roundish ovate, 1-2 lvs.; raceme 3-6 ft. long, bearing as many as 30 fls.; sepals oblong, undulate, apiculate; petals obtuse, apiculate, wider; both light yellow, with many abrupt, narrow, concentric brown markings; blade of the labellum extending beyond the sepals, over 1 in. across, light yellow, with few brown blotches at base. Autumn. Mex. I.H. 30:497. Gn. 16, p. 502. F.M. 1877:246.—A distinct plant resembling an oncidium. Var. *pardinum*, Hort. Lip profusely dotted with brownish crimson. Gn. 16, p. 503.

2. *brevifolium*, Lindl. (*O. coronarium*, Hort.). Plants with leathery, ovate-oblong, spreading lvs. and erect racemes, about 1 ft. high, bearing 10-20 fls. 2-2½ in. diam.; sepals subrotund-unguiculate, undulate; petals similar, smaller; labellum smaller than the sepals, cuneate-emarginate, yellow in front, marked about the column with yellow and purple, with a 3-toothed tubercle on the base. Colombia. I.H. 21: 170. G.C. II. 24: 177; III. 18:489; 19:79. G.M. 34: 819; 38:127.

3. *grande*, Lindl.

BABY ORCHID. Fig. 2561 (redrawn from "The Garden"). Pseudobulbs 2-lvs.: lvs. broadly lanceolate: scape few-fl., twice as long as the lvs.; sepals lanceolate, the lateral ones keeled, yellow, banded with rich reddish brown spots; petals oblong, broader, obtuse, subundulate, apex yellow; labellum

2561. *Odontoglossum grande*.

almost rotund, apex slightly emarginate, yellow, banded and spotted with rusty blotches, and with a large-lobed tubercle on the claw. Autumn. Guatemala. B.M. 3955. F.S. 1:24, 25. P.M. 8:49. Gn. 48, p. 219; 51: 118. G.C. III. 17:41 (abnormal fls.); 42:387.—A magnificent species with half-drooping racemes a foot long, bearing few large, brilliantly colored fls. 5-6 in. diam.

4. *Schlieperianum*, Reichb. f. (*O. Insleayi* var. *maceranthum*, Lindl.). Fls. on erect racemes, pale yellow, blotched and barred with deeper yellow mostly on the

lower half of the segms. Autumn. Costa Rica. G.C. 1865:1082; II. 25:269. F.S. 17, p. 78.—Resembles a small pale *O. grande*, but fine for summer flowering.

5. *Insleayi*, Lindl. (*Oncidium Insleayi*, Barker). Lvs. leathery, oblong, shorter than the raceme: fls. $3\frac{1}{2}$ –4 in. across, yellow, spotted with brown, borne in a stiff, erect raceme; sepals and petals oblong, undulate, nearly equal; labellum shorter, ovate, retuse, sagittate and tuberculate at base, orange-yellow, spotted with reddish brown. Oct.–Dec. Mex. F.S. 1:49. Gt. 39, p. 474.—Free-flowering. Resembles *O. grande*. Var. *spléndens*, Reichb. f. Fls. larger, labellum and segms. clouded with brown, yellow only at the tip. Gn. 25:148. G.C. II. 25:305. Var. *leopardinum*, Hort. A highly colored form: segms. pale yellow, heavily barred with chestnut-brown. R.B. 14:61.

6. *Coradinei*, Reichb. f. (*O. Lindleyanum*, Reichb. f. & Warscz. $\times$ *O. crispum*, Lindl.). A supposed natural hybrid with the habit of *O. crispum*. Raceme arching, few-fl.; fls. stellate, 3 in. across, dark sulfur-color, with few chestnut-brown spots; sepals and petals oblong, acuminate, undulate; labellum shorter, oblong-acute, whitish, with a large oblong red-brown blotch near the center and several smaller ones on the disk; crest 3-toothed on each side. Winter. Colombia. G.C. 1872:1068; II. 24:200; 25:269; III. 25:315.—Resembles *O. triumphans*, but of more slender growth. Var. *supérbum*, Hort. A more robust variety with richly colored fls.: panicle much branched, 2 ft. long. Mex. Var. *grandiflorum*, Reichb. f. Fls. yellow, blotched and spotted with dark brown, large and handsome. Colombia.

7. *Lindleyanum*, Reichb. f. & Warscz. Lvs. linear: raceme lax; fls. 2–3 in. across, thin; sepals and petals yellow, blotched and striped with brown; lateral lobes of the labellum small, white, with purple spots; middle lobe red-brown, tipped with yellow. Spring. Colombia. —A variable species, supposed to be the parent of many hybrids.

8. *luteo-purpureum*, Lindl. Lvs. ensiform, narrowed at base: fls. showy, 2–3 in. across, in a robust horizontal raceme; sepals ovate-oblong, undulate, brownish purple, with a yellow margin; petals similar, toothed and spotted with purple-brown; labellum quadrifid, cordate or oblong, fimbriate, yellow, spotted with purple and rose; crest on the claw pectinate. Winter and spring. Colombia. G.C. II. 21:585. G.W. 2, p. 611. —Owing to its wide geographical scope, this species is extremely variable. A very mixed progeny has resulted from the crossing of this with other species, and the intermixture of the descendants. Var. *radiatum*, Hort. (*O. radiatum*, Reichb. f.). Sepals and petals narrow, yellow, heavily spotted with dark brown; labellum expanded in front, white, shading into a brownish blotch at base. G.C. II. 25:76, 140. Var. *crispatum*, Reichb. f. Front half of the labellum convolute into deep folds, fimbriate. G.C. III. 5:233. Not advertised. Var. *scéptrum*, Reichb. f. Sepals creamy yellow, barred and washed with brown; petals broader-toothed, densely spotted with brown; labellum whitish. I.H. 18:73; 37:99. Not advertised. Var. *hýstrix*, Hort. (*O. hýstrix*, Hort.). Labellum much fringed, and crests very spiny.

9. *facetum*, Reichb. f. (*O. Hallii*, Lindl. $\times$ *O. luteo-purpureum*, Lindl.). Natural hybrid: sepals lanceolate, straight, light yellow, with very large cinnamon-colored blotches; petals lanceolate, straight, finely toothed, with numerous small spots; labellum almost circular, short, finely fringed, convolute, undulate, light yellow, with a semicircle of radiating keels, some of which are fringed and in front of which is a horseshoe-shaped spot.

10. *hebraicum*, Reichb. f. (*O. cristatum*, Lindl. $\times$ *O. cirrhosum*, Lindl.). Natural hybrid: fls. $2\frac{1}{2}$ in. across, borne in a panicle; sepals lanceolate; petals wider, undu-

late, all prettily marked, lemon-yellow, whitish in the center and spotted with red-brown markings suggesting Hebrew characters; labellum triangular or oblong, acuminate, erose-dentate, darker yellow toward the base, with a large maroon blotch and several smaller ones. Winter. Colombia. Gn. 21: 386. G.C. II. 16: 173. Var. *aspermum*, Rolfe. Differs slightly from the type in its lax racemes of golden yellow fls., blotched with purple-brown.

11. *maculatum*, La Llave & Lex. Pseudobulbs ovate, 1-lvd.: lvs. lanceolate, acute, 6–8 in. long; raceme pendulous, loosely many-fl., longer than the lvs.; sepals narrowly linear or lance-oblong, acuminate, brown; petals ovate-lanceolate, acuminate, undulate, yellow, spotted with brown; labellum wide triangular, acuminate, crisp, yellow, brown-spotted, claw short, 2-crested; column white. Mex. B.M. 6455 (not 4878, which is *O. cordatum*, Lindl.). B.R. 26:30.—Fls. freely in June. Racemes a foot long, with stellate fls. 3 in. diam. Var. *Thompsonianum*, Hort. Infl. vigorous, the fls. $3\frac{1}{2}$ in. across; sepals salmon-brown, yellow-margined; petals and lip pale yellow, brown-blotched. G.C. III. 30:77. G.M. 44:547. Var. *spléndens* and var. *supérbum* are recommended.

12. *mirandum*, Reichb. f. Lvs. lanceolate: raceme stiff, 1-sided; sepals and petals lanceolate-acuminate, almost wholly red-brown, with yellow margins; labellum linear-lanceolate, similarly marked, and having a few purple lines at base, callus horned; wings of the column rhomboid-serrate. Colombia.

13. *gloriosum*, Lindl. & Reichb. f. Fls. pallid ochre, spotted with brown, paniculate; sepals and petals oblong-ligulate, acuminate; labellum lanceolate-acuminate, cordate at base, denticulate, about as long as the petals; claw with a 4-lobed, 4-toothed callus; column toothed below the middle. Colombia. G.C. 1865:578; II. 24:680.

14. *odoratum*, Lindl. Pseudobulbs 2–3 in. long, narrowly ovoid, compressed; lvs. 1 ft. long, narrowly ensiform: panicle sometimes 2–3 ft. long, copiously branched and many-fl.; fls. $1\frac{1}{2}$ –2 in. across, dull golden yellow, blotched with brownish red; sepals and petals similar, narrowly lanceolate, acuminate, waved; labellum hastate, lateral lobes short, rounded; terminal lobe broadly subulate, narrowed, pubescent, waved; disk with 2 pairs of longitudinal, obtuse, erect teeth. Winter and spring. Mex. B.M. 6502. G.C. II. 15:337. Var. *latemaculatum*, André. Fls. larger; spots purple-brown, larger and more intense. July, Aug. I.H. 17:39. Gt. 37, p. 492. Free-flowering.

SECTION II.

- A. Labellum more or less constricted in the middle, fiddle-shaped.
- B. Column not winged, but having 2 projecting horns at the apex. 15. *constrictum*
- BB. Column winged; wings pectinate or consisting of few decurved spines. 16. *Hallii*
- BBB. Column winged; wings toothed or entire.
- c. Crest obsolete, 5-ridged 17. *laeve*
- cc. Crest falcate-pectinate 18. *Wallisii*
- ccc. Crest of radiating keels toothed or entire 19. *tripudians*
- cccc. Crest a bifid callosity. 20. *Harryanum*
- 21. *nevadense*
- 22. *Sanderianum*
- AA. Labellum with an ovate or oblong blade, often cordate at the base.
- a. Lateral lobes not upright; labellum with a toothed crest 23. *triumphans*
- 24. *aspermum*
- 25. *cristatum*
- BB. Lateral lobes on the claw fleshy, upright; labellum with obtuse crest or none 26. *cordatum*
- 27. *bictoniense*
- AAA. Labellum hastate 28. *hastilabium*

15. *constrictum*, Lindl. Lvs. linear-lanceolate, elongate; panicle long, slender, loosely branched; fls. 1-1½ in.; sepals and petals nearly similar, oblong-lanceolate, acuminate, bright yellow, blotched with orange-brown; labellum fiddle-shaped, with rounded or truncate, apiculate blade, white, with a rose-colored blotch on each side, toothed. Venezuela. B.M. 5736.—Small-fl., but a profuse bloomer, often bearing 4-5 many-fl. panicles 1-1½ ft. in length. Var. *castaneum*, Hort. Spots on sepals and petals covering nearly the entire surface. I.H. 35:66.

16. *Hállii*, Lindl. Lvs. a foot long, ensiform, narrowed at the base; scape 1-2 ft. long, with a many-fl. raceme of equal length; fls. 3 in. across; sepals and petals spreading, subsimilar, oblong-lanceolate, long-acuminate with recurved points, golden yellow, with transverse bands and spots of yellowish brown; labellum

slender, drooping, mostly unbranched racemes, bearing few large fls.

19. *tripudians*, Reichb. f. & Warscz. Lvs. 7-9 in. long, linear-lanceolate; raceme stiff, erect, longer than the lvs., 8-10-fl.; fls. 2 in. across, dull yellow-green on the back; sepals oblong-acute or subacuminate, dark brown, with yellowish green tips and bases; petals similar, with yellowish bands; labellum short, panduriform, as long as the segms., white, with rose-colored blotches, with about 10 keels radiating from the disk; lateral lobes rounded, crenulate; central lobe subreniform, erose-dentate. Peru. B.M. 6029. F.M. 1876:208; 1880:407. O. 1909, p. 28.

Var. *Harryanum*, Reichb. f. Sepals and petals almost blackish inside, tipped with light yellow, with a few similar marks at the base of the petal; labellum light yellow, with the base covered with rich mauve purple.

20. *Harryanum*, Reichb. f. Lvs. about 2, oblong-ligulate, obtuse, 6-12 in. long; raceme up to 3 ft. long, bearing 6-12 large fls.; sepals and petals ligulate-oblong, acute, wavy, brown with irregular, transverse, greenish yellow markings; the petals project forward; labellum large, flat, undulate, somewhat panduriform, lower half white, changing to yellow; upper half brownish marked with mauve lines and having about 7 serrated crests; column with 2 very small toothed wings. Colombia. Gn. 33:76. G.C. III. 2:169. Same as var. of No. 19(?).

21. *nevadense*, Reichb. f. Pseudobulbs ovate, acuminate; lvs. linear-lanceolate, base narrow, keeled; sepals and petals similar, lanceolate, long-acuminate, dark brown with a golden margin, outside dark green; limb of the labellum wide, hastate, deflexed, fimbriate, white-spotted; apex acute, subincurved, appendage on the claw bifid. Spring. Colombia. I.H. 17:45. Gn. 19, p. 425; 32, p. 589; 39, p. 250. G.C. II. 16:461; 24:201. G. 16:415.—A showy plant, with slender, arching, 6-10-fl. panicles, and fls. 3-4½ in. across.

22. *Sanderianum*, Reichb. f. Resembling *O. nevadense*. Fls. stellate; sepals and petals lanceolate, acuminate, yellow, with numerous chocolate-brown markings; labellum cuneate, panduriform, apiculate, toothed, white or pale yellow, with a purple blotch in front; lateral lobes erect. Early spring. Trop. Amer.—Free-flowering.

23. *triumpans*, Reichb. f. Pseudobulbs 3-4 in. long; lvs. oblong-lanceolate, 1-1¼ ft. long; scape arching, branched and many-fl., 2-3 ft. long; fls. 3-4 in. across; sepals and petals lance-oblong, subacuminate, undulate, yellow, blotched with deep crimson-brown; labellum ovate, cordate, acute, toothed and undulate, white with a roseate tip; crest of yellow or white teeth. March, April. Colombia. I.H. 16:609. G.C. 1867:516; II. 24:205; 25:141; III. 27:213 (var.) R.B. 18:121. G.M. 34:89. F. 1877:217. G. 28:185.

24. *aspersum*, Reichb. f. (*O. maculatum*, La Llave & Lex. × *O. Rössii*, Lindl.). Natural hybrid; lvs. oblong, acute; raceme few-fl.; sepals ligulate, acute, keeled, pale yellow, mottled with numerous brown blotches; petals oblong, acute, much broader, similar in color; labellum with a cordate, acute blade wholly whitish, callus toothed, yellow, with brown lines, pubescent. Feb., March.—Free-flowering.

25. *cristatum*, Lindl. (*Oncidium cristatum*, Beer). Lvs. linear-lanceolate, a little shorter than the many-fl. scape; sepals and petals lanceolate-acuminate, yellow, spotted with brown; labellum oblong-lanceolate, white; apex and margin brown, with purple striae, with a digitate crest on the disk; wings of the column semi-ovate or subquadrate. Peru. I.H. 17:21. Var. *Dayanum*, Reichb. This is colored like the type, but the lip is rhomboid, apiculate, serrate, and the teeth of the crests on the labellum cross each other like the bristles on the nearly closed leaf of *Dionaea muscipula*.



2562. *Odontoglossum crispum*. (×½). No. 34.

white, with a blood-red spot on the middle lobe and few spots on the lateral ones, erose-dentate, midlobe emarginate, with a short awn in the sinus, with 2 spinous crests on the claw. July. Ecuador. B.M. 6237. I.H. 18:58. F.S. 17, p. 81. G.C. 1865:962; II. 25:140.—The spots on the labellum are sometimes scattered.

17. *lève*, Lindl. (*O. Reichenheimii*, Lind. & Reichb. f.). Lvs. 6-10 in. long, oblong-lanceolate; sepals and petals oblong-linear, acute, plane, yellow, blotched with cinnamon; labellum smaller, white in front, violet on the upper half. Spring. Guatemala. B.M. 6265. I.H. 6:213. B.R. 30:39.—Plants bear 4-6 strict, stout panicles, 3 ft. long, with numerous fls. 2 in. diam. Not much esteemed.

18. *Wallisii*, Lind. & Reichb. f. (*O. bellulum*, Hort.). Lvs. linear-lanceolate; sepals and petals ligulate, honey-colored, marked with brown streaks; labellum white, with a violaceous anterior part and marked with similar streaks at the base, with 3-falcate calli on the base. Dec. Colombia. I.H. 18:56; 38:127.—Elegant, with

26. *cordatum*, Lindl. Pseudobulbs oblong, 1-lvd.: lvs. oblong, acute, 6-8 in. long; fls. large and handsome, with the sepals and petals yellowish green, richly blotched with brown; labellum cordate, acuminate, suberenate, white, with a purplish crest at base and spotted with brown on the limb; sepals lance-linear, acuminate; petals broader and longer, undulate. Mex. B.M. 4878 (as *O. maculatum*). I.H. 26:355. P.M. 13: 147. Gn. 27:46. F.C. 3:100.—St. 2-3 ft. high: few or many-fl'd.

27. **bictoniense**, Lindl. Pseudobulbs oblong, 2-3 in. long, 2-3-lvl.-lvs. 1 ft. long, ensiform, undulate, spreading; raceme 3 ft. long; fls. 1½ in. across; sepals and petals subequal, linear-lanceolate, greenish yellow, blotched with brown; claw of the labellum bilamellate, blade cordate, acuminate, undulate, white or roseate. Autumn. Guatemala. B.M. 3812 (as *Zygopetalum africanum*).—This was the first odontoglossum to reach England in a living state. It is free-flowering, but not so good as plants subsequently intro. Var. **album**, Hort. Like the type, but labellum pure white instead of wine-red; sepals and petals brown. I.H. 19:91.

Var. *spléndens*, Ch. Lem. Labellum rose-lilac; other segms. spotted. Seems to be like the type, with more pronounced color. I.II. 12:449.

28. *hastilabium*, Lindl. Lvs. linear-oblong: scape $1\frac{1}{2}$ ft.; bracts long, deciduous; fls. numerous, large, handsome, varied with pale green, purple and white, fragrant; sepals and petals spreading, lanceolate, very acuminate, pale green, with transverse purple dots and lines; labellum large, the lateral lobes forming 2 horns at base, the central one with a purple, crested claw, and orbicular-ovate, white, acute blade; column slender, winged, purple. Summer. Colombia. B.M. 4272. G.W. 13, p. 620.

SECTION III.

- | | | |
|---|-----|---------------|
| A. Column without wings..... | 29. | ramosissi- |
| | | [mum] |
| AA. Column with 2 spreading awns..... | 30. | nævium |
| | | 31. cirrhosum |
| AAA. Column pluricirrhose; segms. lanceo- | | |
| late..... | 32. | Ruckerianum |
| AAAA. Column with fimbriate or toothed | | |
| wings; segms. ovate or rhomboid..... | 33. | nobile |
| | 34. | crispum. |

29. *ramosissimum*, Lindl. Lvs. linear-oblong, acute, 1 ft. long; panicle much branched and many-fl'd., 2 ft. long; fls. 2 in. across, white, spotted with pale purple or violet; sepals and petals very undulate, narrowly ligulate, the latter wider; labellum rhomboid, acuminate, cordate at base, crested, tomentose. March, April. Colombia. J.H. III. 29:77. L.H. 40:170 (var. *calceste*, Lind. & Rod.).—A distinct and beautiful plant whose fls. have been likened to large spiders.

30. *nævium*, Lindl. & Paxt. Pseudobulbs oblong: lvs. thin, lanceolate: panicle erect, arching, much branched, bearing numerous star-shaped fls.; sepals and petals 2 in. long, narrowly lanceolate, beautifully crenate-undulate, white, profusely spotted with rose-purple; labellum shaped nearly like the petals, shorter and broader, with 2 large crests on the yellow base. May, June. Colombia. F.S. 6:594. G.M. 31:559. B.M. 8097.—Closely allied to *O. cirrhosum*.

31. *cirrhosum*, Lindl. Pseudobulbs lanceolate, compressed, 2-3 in. long; lvs. 4-6 in. long, linear-ensiform, leathery; panicle often over 2 ft. long, drooping, or inclined; fls. 3 in. across, snow-white, blotched with crimson or brown, base of the labellum yellow, with brown lines at the sides; sepals narrowly lanceolate, ending in long, curved points; petals wider; labellum two-thirds the length of the petals, with 2 ciliate lateral lobes and a narrow acuminate middle lobe. April, May. Ecuador, Peru. B.M. 6317. I.H. 25:301. Gt. 41:1383. Gn. 9, p. 401; 16, p. 19. G.C. II. 5:501, 503;

9:181; 25:12. F.M.1876:222.—This species sometimes produces stout few-fl'd. sts., which should be cut to save the vigor of the plant.

32. **Ruckerianum**, Reichb. f. Related to *O. crispum*: sepals and petals lanceolate, acute, creamy white, bordered with violet and spotted with brown, waved; labellum rather narrow, oblong, angular-lobed on each side of the base, yellow at base, with few chestnut-brown blotches; callus rhomboid serrate. Colombia. G.C. 1873:105; II. 24:204, 748 (var. *insigne*). J.H. III. 30:455 (var. *splendens*).

33. *nobile*, Reichb. f. (*O. Pescatorei*, Lind.). Pseudobulbs ovate, bearing 2 strap-shaped lvs.; panicle 2-3 ft. long, diffuse, bearing numerous white, membranaceous fls. slightly tinged with rose; sepals ovate-oblong, slightly undulate; petals similar but much wider; labellum cordate-oblong, pandurate, with a yellow fimbriate crest and a few rose-colored spots. Spring. Colombia. F.S. 16:1624. I.H. 28:407. Gn. 21:216 (as *O. excel-lens*). G.C. II. 24:212; III. 3:245; 7:200; 25:69.; 35:131. A.F. 5:183. J.F. 4:331. J.H. III. 60:389. G. 31:285; 36:307.—A fine species producing numerous large, erect panicles. Var. *Veitchianum*, Reichb. f. Like the type, but the parts of the fl. have large, crimson-purple spots. Gn. 26:112.

34. *crispum*, Lindl. (*O. Bluntii*, Reichb. f. *O. Alexandræ*, Batem.). Figs. 2562 and 2563. Pseudobulbs ovate, compressed, about 3 in. long; lvs. linear, 1 ft. long; panicles rather short, but attaining a length of 2½ ft., with few short branches and crowded fls.; fls. white, variously spotted with crimson, brown, etc., or tinged with rose, 2-3 in. across; sepals ovate to ovate-lanceolate, often undulate;



2563. Habit sketch of *Odontoglossum crispum*.



2563. Habit sketch of *Odontoglossum crispum*.

rhomboid, toothed and undulate-crisp; labellum oblong-ovate, fringed with teeth, wavy and crisp. Fls. are produced at any season of the year. Colombia. F.S. 16. 1652. Gn. 4, p. 241; 20:12; 21, p. 95; 23, p. 210; 40, p. 596; 46, p. 149; 53, p. 297. R.B. 21:3. Gng. 6:24; 16:133. J.H. III. 34:499; 49:329; 62:449. G.C. III. 24:379; 23:165, 390; 25:67, 179, 187; 43:4. A.F. 13: 34. F.E. 9:327. G. 4:619; 9:223; 24:662; 26:198. 35: 333. G.M. 50:527. G.Z. 21, p. 145. O. 1910, p. 24. C.L.A. 10:413; 20, Aug., p. 44.—As was stated in the introduction, this species has probably more than 100 named varieties. Many besides those cited have been figured in horticultural and botanical works. Very few varieties are found in American trade lists, but some of the most distinct are given below:

Var. *Andersonianum*, Hort. (*O. Andersonianum*, Reichb. f.). Fls. creamy white, with broad, longitudinal bands of cinnamon. F.M. 1872:45. G.C. II. 24:680, 681; III. 17:739. G.W. 13, p. 619.—Listed in Amer.

Var. **apiatum**, Ballantyne. Fls. very large; sepals and petals lacinate on the edges, white, with rich chocolate-brown blotches. G.C. III. 15:375.

Var. *Ashworthianum*, O'Brien. Fls. almost entirely rose-purple, with white margins and a few white marks on the sepals and petals. G.C. III. 19:197.

Var. *Coöksoniæ*, Hort. Fls. 4 in. across, the segms. fringed and heavily tinged with purple on back, the face pure white around the column, the margins white, tinged purple in places, the segms. with a large central

purple-red blotch, surrounded with smaller blotches. G.C. III. 33:109.

Var. *Fowlerianum*, Hort. Fls. white, the sepals with 2 large irregular ruby-crimson blotches and smaller purple ones, the petals with large ruby-crimson blotches separated by narrow white lines; lip crimped, purple-marked, the crest yellow. G.C. III. 41:278; 45:211.

Var. *Gouvilleanum*, André. Fls. large, white; petals irregularly toothed, with few small crimson blotches; sepals heavily blotched. R.H. 1888:132.

Var. *Grairianum*, Hort. Sepals and petals for most part a glowing yellowish rose, the margins white with a few white inward-running lines; crest yellow. G.C. III. 33:407.

Var. *guttatum*, Hort. (*O. Alexandræ* var. *guttatum*, Hook.). Sepals linear-oblong, with several pale purple blotches; petals broader, similarly spotted; labellum oblong-quadrate, contracted in the middle, spotted with rose and having a large rose patch on the disk. B.M. 5697.

Var. *Kärthausii*, Hort. Sepals and petals strongly toothed, pure white or tinted in places on the margins, with several large irregular, more or less confluent bright purple central blotches; lip marked with red-brown. C.O. 1 s.

Var. *Léhmanni*, Hort. Labellum broadly ovate, bright ruby-red, broadly edged with white; crest yellow; sepals and petals tinged with rose, with few red spots. G.C. III. 24:147.—In American trade.

Var. *Lúciani*, Hort. Sepals and petals violet on back, marked on face with large irregular purple-brown blotches. C.O. 1 s.

Var. *maculatum*, Hort. Fls. white, spotted with purplish brown; petals suborbicular, lacinate-toothed. G.C. III. 16:248.

Var. *Mariæ*, André. Fls. pure white, except a few red spots on the base of the sepals. I.H. 25:325.



2564. *Odontoglossum Cervantesii* var. *decorum*. ($\times \frac{1}{2}$)

Var. *Mundyum*, Hort. Fls. white, rose-purple tinged, heavily blotched with chestnut or red-brown, the center of lip bright yellow. G.C. III. 27:117.

Var. *Pittianum*, Hort. Fls. white, slightly rose-tinged, the acuminate sepals and petals heavily blotched with red-brown, the back heavily tinged with purple; lip with a yellow crest marked with reddish lines and brown-spotted. G.C. III. 30:151. G.M. 49:212.

Var. *purpurascens*, Hort. Fls. heavily tinged with rose-purple, the dorsal sepal and petals with numerous small well-defined reddish purple spots, the spots on the lateral sepals obscured by the coloring; lip white with reddish blotches in front, the crest yellow, with a

few reddish lines. G.C. III. 29:233. G.M. 46:391. J.H. III. 42:275.

Var. *Sänderæ*, Hort. Fls. purple-tinted, heavily blotched with reddish orange-brown. G.C. III. 33:416. J.H. III. 43:3.

Var. *Schroëderi*, Hort. Fls. with 1 or 2 large and several small, brownish red spots on the white segms. Advertised in Amer.

Var. *Trianæ*, Hort. (*O. Alexandræ* var. *Trianæ*, Hook.). Dorsal sepals with a single roseate spot; lateral sepals suffused and spotted with rose; petals pure white; labellum with a large 2-lobed spot. B.M. 5691.

Var. *Veitchianum*, Hort. Sepals ovate, undulate, white, with several brownish crimson spots; petals broader, color like the sepals but mostly in one large central blotch; margins undulate and toothed. G.C. III. 1:799. F. 1884:177. G.Z. 30:217.

SECTION IV.

A. Sepals and petals similarly colored.

B. Column without wings.

c. Pseudobulbs compressed and edged.

D. Labellum white or colored like the petals.....

35. *madrense*

36. *nebulosum*

DD. Labellum violet.....

37. *Krameri*

CC. Pseudobulbs smooth, terete.....

38. *Oerstedii*

BB. Column with entire wings.....

39. *Cervantesii*

BBB. Column with toothed or crenate wings.

C. Labellum reniform.....

40. *citrosimum*

CC. Labellum oblong-quadrate.....

41. *pulchellum*

42. *Egertonii*

AA. Sepals and petals dissimilar in color.....

43. *Rossii*

44. *Dawson-*

ianum

35. *madrense*, Reichb. f. (*O. maxillare*, Hook.). Pseudobulbs long-ovoid: lvs. strap-shaped, 10 in. long: fls. $2\frac{1}{2}$ in. across, 4-10 in a raceme; sepals and petals lanceolate, keeled, white, with a purple blotch at the base; labellum shorter than the sepals, the lateral lobes forming 2 acute recurved appendages on the claw, middle lobe trowel-shaped, white, with a yellow base and an orange blotch. Summer. Mex. B.M. 6144. I.H. 30:480. F.M. 1875:158. Gn. 10, p. 443. G.C. II. 25:116 (seed-pod). G.M. 39:117. G. 2:535.

36. *nebulosum*, Lindl. (*O. maxillare*, Lindl.). Pseudobulbs 2-3-lvd.: lvs. oblong, acute, 9 in. long: scape about as long as the lvs., 5-6-fl.; fls. 3 in. across, pure white, with the bases of all the parts profusely spotted with brown; sepals membranaceous, oblong; petals similar but wider, all pubescent at the base; labellum with 2 large, erect lobes on the yellow claw; limb ovate, acute, dentate, pubescent. Mex., at an elevation of 10,000 ft. I.H. 6:200. G.C. 1867:572; II. 25:597. Not B.M. 6144, which is *O. madrense*. Var. *candidum*, Reichb. f. Sepals and petals pure white, with a brown blotch and a few spots on the labellum. G.C. 1867:710; II. 25:596. Var. *guttatum*, Reichb. f. Sepals and petals spotted to above the middle. I.H. 31:524.

37. *Krameri*, Reichb. f. Pseudobulbs subrotund, compressed and sharply 2-edged, 1-lvd.: lvs. 7-9 in. long, $1\frac{1}{2}$ -2 in. broad, keeled; scape 4-8 in. long, inclined or pendulous, 3-5-fl.; fls. $1\frac{1}{2}$ in. diam.; sepals and petals subequal, oblong-acute, pale violet-red in the center, with broad white margins; labellum with a stout yellow excavated claw bearing 2 erect calli; middle lobe subquadrate, 2-lobed, pale violet, with white and brown streaks at base. Costa Rica and Mex. B.M. 5778. I.H. 32:562. F.S. 23:2469. G.C. 1868:98; II. 25:756.

38. *Oerstedii*, Reichb. f. Plants small: lvs. linear-oblong, 4-5 in. long, narrowed to a petiole: raceme suberect, few-fl.; fls. $1\frac{1}{2}$ in. across, white, with the base of the labellum golden yellow; sepals and petals broadly

oblong, the latter narrowed to a short claw; labellum sessile; lateral lobes small, auriculate; middle lobe suborbicular, plane, deeply bifid. Feb.-May. Costa Rica. B.M. 6820. Gn. 26:160. G.C. II. 7:811; 25:757; III. 19:77. G. 28:261.

39. *Cervantesii*, La Llave & Lex. (*O. membranaceum*, Lindl.). Pseudobulbs usually 4-angled, 2 in. long, bearing a single oblong lf. 4-6 in. long; scape sheathed with large bracts, bearing 2-6 membranaceous fls.; fls. 2 in. across, pure white, with transverse streaks of red near the bases of the segms.; sepals broadly lanceolate to oblong; petals ovate-rotund; labellum with a yellow claw; lateral lobes small; middle lobe large, broadly cordate. Fls. produced in winter, very fragrant and lasting several weeks. Mex. B.M. 4923. B.R. 31:36; 32:34. I.H. 1:12. P.M. 12:193. Gn. 19, p. 333; 32, p. 323. G.C. II. 15:753. F. 1881, p. 43. Var. *majus*, Hort. Fls. larger, with brighter spots. I.H. 25:313. Var. *decorum*, Hort. Fig. 2564. Fls. large, spotted inside and outside with bright red. I.H. 36:90. Gn. 32:322. J.H. III. 30:423. F.M. 1877:254. Var. *Andersonii*, Hort. Fls. white; base of the sepals and petals barred with reddish brown; labellum bordered with spots of the same color. Mex.

40. *citrósmum*, Lindl. Fig. 2565. Pseudobulbs subrotund, compressed, smooth, 1-lvd.: lvs. oblong, obtuse, thick, somewhat shorter than the raceme; scape pendent, 8-12-flid.; fls. large and full in outline, 3 in. across, white to rose, with a violet labellum; sepals and petals oblong, obtuse; labellum unguiculate, reniform. May, June. Guatemala. B.R. 29:3. R.B. 21:265. F.S. 6:633. A.F. 35:480. Gn. W. 18:545. J.F. 1:90. J.H. III. 51:27. Var. *album*, Veitch. Fls. white, except the yellow claw of the labellum. Gn. 24:414. Var. *rosellum*, Lem. Fls. rose-colored, except the yellow claw of the labellum. I.H. 2:59. Var. *roseum*, Veitch. Blade of the labellum deep rose. Var. *punctatum*, Veitch. Fls. pale rose; sepals and petals spotted with purple. A variety called *maximum* is also advertised.

41. *pulchellum*, Batem. Pseudobulbs oblong, compressed, 2-lvd.: lvs. grass-like, rather stiff or rigid, 9-12 in. long; scape weak, 6-7-flid.; fls. white, except the yellow crest of the labellum; sepals ovate, acute; petals obovate, acute, somewhat undulate; lateral lobes of the labellum triangular, middle lobe oblong, subquadrate, apex recurved; column very short, with 3 fimbriate wings. Spring. Guatemala. B.M. 4104. B.R. 27:48. O. 1912, p. 150. G. 33:153.—Easily grown, and never fails to blossom. The fl.-spikes suggest the lily-of-the-valley. Fragrant. Var. *majus*, Hort. More robust than the type, with larger fls. Var. *grandiflorum* is listed.

42. *Égertonii*, Lindl. Like *O. pulchellum*, but with the fls. only half as large; labellum acute, not almost truncate, excavated at the base and with 2 teeth

inflexed over the excavation. Guatemala.—This is probably only a form of *O. pulchellum*.

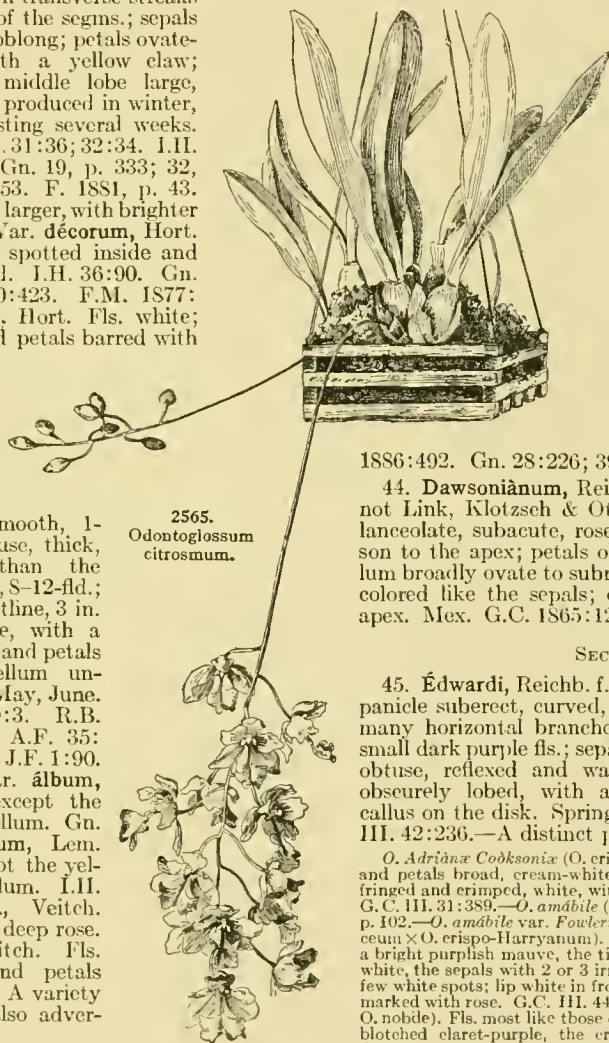
43. *Rössii*, Lindl. Pseudobulbs small, much compressed, 1-lvd.: lvs. about 6 in. long; raceme about as long as the lvs., 2-5-flid.; fls. 2-3 in. diam.; sepals lanceolate, acuminate, cream-colored to greenish yellow, with short bars of dark brown; petals white, with a few brown spots at base, oblong, obtuse, revolute; labellum round-ovate, emarginate, undulate, pure white, except the yellow claw. Winter. Mex. F.C. 3:129. B.R. 25:48. Gn. 19, p. 306; 28:226. F.S. 20:2110.—This is an extremely variable species, and probably includes the forms cult. as *O. Ehrenbergii* and *O. Dawsonianum*, which are united with this species by some authors. The name *majus* has been applied to several varieties. Probably I.H. 1:30 (as *O. Ehrenbergii*) and F.S. 8:846 (as *O. Ehrenbergii*) = *O. apterum*, ex-Index Kewensis) also belong here. Var. *rubescens*, Carr. (*O. Rössii majus rubescens*, Hort.). Fls. large; petals clear rose, with dark brown spots at the base. R.H. 1886:492. Gn. 28:226; 39, p. 345. G.C. II. 21:345.

44. *Dawsonianum*, Reichb. f. (*O. Ehrenbergii*, Hort., not Link, Klotzsch & Otto). Raceme few-flid.; sepals lanceolate, subacute, rose-colored, blotched with crimson to the apex; petals oblong, acute, pure rose; labellum broadly ovate to subrotund, crenulate; apex retuse, colored like the sepals; callosity with 2 teeth at the apex. Mex. G.C. 1865:1226; II. 25:469. F.S. 17, p. 76.

SECTION V.

45. *Édwardi*, Reichb. f. Lvs. 2 ft. long, strap-shaped; panicle suberect, curved, 2 ft. long, the rachis bearing many horizontal branches covered with many rather small dark purple fls.; sepals and petals oblong to ovate-obtuse, reflexed and wavy; labellum tongue-shaped, obscurely lobed, with a prominent yellow lobulate callus on the disk. Spring. Ecuador. B.M. 6771. J.H. III. 42:236.—A distinct plant, easily cult.

O. Adriana Cocksonia (*O. crispum* × *O. Hunnewellianum*). Sepals and petals broad, cream-white, evenly brown-blotched; lip finely fringed and crimped, white, with fine brown spots and yellow crest. G.C. III. 31:389.—*O. amabile* (*O. crispum* × *O. spectabile*). O. 1913, p. 102.—*O. amabile* var. *Foulerianum* (*O. crispum punctatum* violaceum × *O. crispum* Harryanum). Fls. 4 in. across, the sepals and petals a bright purplish mauve, the tips pale violet, the margins silvery white, the sepals with 2 or 3 irregular white lines, the petals with a few white spots; lip white in front, and red around the yellow crest, marked with rose. G.C. III. 44:4.—*O. ardentissimum* (*O. crispum* × *O. nobde*). Fls. most like those of *O. crispum* in size and form, white, blotched claret-purple, the crest yellow with reddish markings. G.C. III. 32:50.—*O. aspidorhinum*, Lehm. Fls. 9-15, the sepals and petals oblong, contracted into long points, yellow, blotched with red-brown; lip subquadrate, clawed, white, spotted with lilac-rim. Colombia. G.C. 31:643.—*O. Bingleianum* (*O. crispum* × *O. Harryanum*). G.M. 51:69.—*O. blandum*, Reichb. f. Sepals and petals pale yellowish white, spotted with crimson-brown, cuneate-lanceolate, acuminate; lip ovate, acuminate, crisped. Colombia.—*O. Bradshawii* (*O. Andersonianum* × *O. Harryanum*). Fls. 4½ in. across, resembling more those of *O. Harryanum*, yellow, tinged with rose on back of sepals, marked on the face below with numerous red-brown blotches, more or less confluent in groups. G.C. III. 33:82. G.M. 46:87. Gn. 63, p. 184.—*O. caruleum* (*O. armainvillense* × *O. crispum*). Fls. resembling in shape those of *O. armainvillense*, the greater part of the segms. marked with confluent blotches of violet-purple. G.M. 50:113.—*O. Clayii* (?).—*O. Craushayianum* (*O. Hallii* × *O. Harryanum*). Fls. intermediate in shape between the parents, but more like *O. Hallii* in color. G.C. III. 30:77.—*O. crispum* Harryanum (*O. crispum* × *O. Harryanum*). More like the second parent in shape, the sepals and petals light yellow, smaller basal markings of red-brown. G.C. III. 45:133. G.M. 52:141.—*O. Edgertonianum*—perhaps *O. Egertonii*,—*O. Foulerianum* (*O. cirrhosum* × *O. Rössii*). Sepals and petals narrow, thickly spotted deep purple, bright rose-purple on margins and tips, the lip rose-



purple, the callus yellow. G.M. 49:181. Gn. 69, p. 173.—*O. Gröyana* (O. Edwardi × O. Uroskinneri). Fls. rose-purple, with the crest yellow. G.C. III. 49:72.—*O. harvengtense* (O. crispum × O. triumphans). Sepals and petals pale yellow, spotted with red-brown, the latter with a paler central strip, the lip brown-spotted, the center yellow, the margins white. C.O. 4.—*O. Harwoodii* (O. Wagnianum × O. maculatum auriferum). Fls. yellow, spotted dark purple. G.C. III. 49:98. G.M. 54:93.—*O. Lambeauianum exultans* (O. crispum Madame Folcke × O. Rolfeae ardentissimum). Segms. white, rose-suffused on petals, blotched red-brown. G.C. III. 38:434. C.O. 12. O.R. 14:57.—*O. Laurencianum* (O. Rolfeae × O. triumphans). Fls. bright yellow, heavily brown-barred, the white lip purple-blotched. Gn. 67, p. 207.—*O. Lecanum*, Reichb. f. Fls. yellow, brown-blotched. Colombia. B.M. 8142. J.H. III. 43:193.—*O. Lucasianum* (O. cristatellum × O. Hallii). Sepals and petals chocolate, margined and tipped yellow, lip cream-white, brown-spotted.—*O. Ossutonii* (O. nobile × O. spectabile). Sepals and petals cream-yellow, spotted and blotched brown, the sepals flushed rose. G.W. 13, p. 212. G.M. 49:419.—*O. Phalanopsis*—*Miltonia Phalanopsis*.—*O. ramulosum*, Lindl. Fls. bright yellow, with a large basal blotch of brown on dorsal sepal and petals, the lateral sepals brown-spotted, the lip with a brown band in front of the orange crest. Colombia. B.M. 8031.—*O. Roelzii album*—*Miltonia Roelzii* alba.—*O. Rolfeae* (O. Harryanum × O. nobile). Fls. ivory-white, with numerous small purple spots, those of the lip basal, those on the petals in a central zone, the sepals slightly purple-stained at tip. Gt. 58:1580.—*O. rosefieldiense* (O. Harryanum × O. Lambeauianum). Fls. white, slightly tinged pink, blotched with various shades of reddish claret. G.C. III. 49:163.—*O. Smithii* (O. Rossii × O. spectabile). Sepals and petals light green, margined with violet-purple, in upper half blotched black-brown, the front lobe of lip violet-purple, the disk and crest yellow. G.C. III. 38:427; 45:212. G.M. 48:805.—*O. Thompsonianum* (O. crispum × O. Edwardi). Fls. rich claret-purple, the margins and tips rosy, the crest deep yellow.—*O. venustum* (O. armainvillarense × O. spectabile). Fls. white tinged lilac and heavily purple-blotched. G.C. III. 38:2.—*O. vexillarium*—*Miltonia vexillaria*.—*O. Vuylstekei* (O. spectabile × O. Vuylstekei). Fls. rosy claret, with slight silvery white lines between the confluent blotches. G.C. III. 38:379. G.M. 48:743.—*O. Vuylstekei* O. Durisonae × O. triumphans). Sepals and petals deep red-brown, the apex and margins light yellow, a narrow irregular transverse line about the middle, the lip whitish with few irregular brown spots. G.M. 47:59.—*O. waltonense* (O. crispum × O. Keckeljanii). Fls. resemble in shape more those of O. crispum, soft canary-yellow, the lip pandurate with a bright red-brown blotch in front of crest. G.C. III. 33:51. G.M. 46:73. O.R. 11:49.—*O. Warneri*—*Oncidium Warneri*.—*O. Wattianum Crausshayianum* (O. Harryanum × O. Lindleyanum). Sepals and petals yellow, closely marked with brown, the lip white with a large violet-purple blotch and some smaller ones. G.C. III. 28:286.—*O. Wattianum princeps* (O. Harryanum × O. Lindleyanum). Sepals and petals pale yellow, heavily blotched with chocolate-purple, the white lip with violet basal markings. G.C. III. 41:135.—*O. Weldonii*—*Miltonia Warszewiczii*.—*O. Wendlandianum Crausshayianum* (supposedly a natural hybrid). Sepals purple, yellow-margined, with a few basal chocolate blotches, the petals tinged claret, profusely spotted with brownish purple. G.C. III. 27:275. G.M. 43:521.—*O. Wignianum* (O. harvengtense × O. Rolfeae). Sepals and petals bright canary-yellow, the sepals bearing few large, the petals numerous small red-brown spots, the lip white at base, primrose in front, with a few purple spots at the middle. G.C. III. 37:274.—*O. Wilkeanum Rothschildianum* (O. crispum × O. luteo-purpureum). Sepals yellow, blotched and barred with brown, the petals light yellow, marked with brown in center, the lip fringed, orange-yellow at base, the front lobe yellow with a large purple blotch. G.C. III. 32: suppl. Dec. 6.—*O. Wignianum* (hybrid). Fls. white, the middle area of segms. blotched with red-purple. G.C. III. 15:211.

HEINRICH HASSELBRING,
GEORGE V. NASH.†

ODONTÒIA (compounded of *Odontoglossum* and *Miltonia*). *Orchidaceae*. A genus established to include hybrids of the genera *Odontoglossum* and *Miltonia*.

Odontòia brugensis = O. Edwardi × M. vexillaria.—*O. Chilletii* = O. Harryanum × M. vexillaria.—*O. Cleverlyana* = O. Rolfeae × M. vexillaria Leopoldii.—*O. decora* = O. Adrianæ × M. Warszewiczii.—*O. Elwoodii* = O. cirrhosum × M. Roelzii.—*O. Fanyanana* = O. Adrianæ × M. vexillaria Empress Augusta.—*O. Farnesiiana* = O. Edwardi × M. Warszewiczii.—*O. Firminii* = O. crispum × M. vexillaria or M. Phalanopsis.—*O. Lairdesse* = O. crispum × M. Warszewiczii. O.R. 13:217. G.C. III. 38:2.—*O. Lambeauiana* = O. Lambeauianum × M. Warszewiczii.—*O. Langoroyi* = O. Uroskinneri × M. Schroederiana.—*O. MacNabiana* = O. Edwardi × M. Bleuana.—*O. ornata* = O. Wilkeanum × M. Warszewiczii.—*O. Vuylstekei* = O. amabile × M. vexillaria gigantea.

GEORGE V. NASH.

ODONTOSÒRIA (Greek, *toothed leaf*, alluding to the fact that the sori are on slender segms. of the leaf). *Polypodiaceae*. A group of tropical ferns formerly included with *Davallia*; characterized by the decoupled lvs. with cuneate ultimate segms. and the com-

pressed suborbicular or cup-shaped indusium which is attached at its sides and open only at the top. For cult., see *Fern*.

chinensis, J. Smith (*Davallia chinensis*, Smith. *Stenodoma tenuifolia*, Fée). Lf.-blades 12–18 in. long, 6–9 in. wide, quadripinnatifid, on polished dark brown stalks which rise from stout creeping fibrillose rootstocks; ultimate divisions with toothed cuneate lobes; sori terminal, usually solitary. Trop. Asia and Australia. Var. *stricta*, Hort., has a more upright habit and narrower lvs.

L. M. UNDERWOOD.
R. C. BENEDICT.†

CECEÓCLADES: *Saccolabium*.

CENÂNTHE (name refers to the vinous scent of the flowers). *Umbelliferae*. About 30 species of glabrous often aquatic perennial herbs, rarely transferred to grounds; some kinds are poisonous. They are widely distributed about the world in temperate regions: roots fibrous or tuberous: lvs. 1–3-pinnate, much dissected, sometimes reduced to a hollow or fistular petiole: fls. white, small, in compound umbels, often polygamous and the outer ones usually sterile and rayed; calyx-teeth minute; petals 2-lobed or notched with an inflexed point. *Ce. fistulosa*, Linn. WATER DROPWORT, native in Eu., W. Asia and N. Afr., is listed abroad; roots of many fleshy fibers, running deep: st. 2–3 ft. high, stoloniferous, very hollow and thick, little branched; radical lvs. 2-pinnate, the lobed segms. cuneate; st.-lvs. reduced mostly to hollow stalks, bearing at the apex only a few linear-lobed segms.: umbels terminal, each with 3–5 rays. Adapted to wet places, for its ornamental and interesting character.

L. H. B.

CENOCÁRPUS (wine fruit, as some of the species yield a beverage). *Palmaceae*. A few species of S. American tall pinnatisect-lyd. palms differing from *Euterpe* in character of calyx and infl.; little grown, but numerous in the Amazon and Orinoco countries. The lvs. are borne in a large crown, and the fls. are in spikes arising beneath the lvs. Some of the species yield useful oil: fr. a medium-sized usually purple or black berry. *Ce. Bacaba*, Mart., and *Ce. Bataia*, Mart., are the species most likely to be mentioned.

CENOTHÈRA (said to be Greek for *wine-scenting*; in allusion to an ancient use of the roots). *Onagraceae*. EVENING PRIMROSE. Flower-garden and border plants, prized for their showy bright yellow, rose or white flowers.

Herbs, or sometimes shrubby at the base, annual, biennial and perennial, with alternate simple or pinnatisect lvs. and mostly showy fls., which are yellow, white or rose-color: calyx with a tube prolonged beyond the angled or cylindrical ovary, with 4 usually strongly reflexed lobes; petals 4, mostly obovate or spatulate; stamens 8, with narrow mostly versatile anthers: fr. a 4-valved loculicidal caps.—The *cenotheras* are mostly dry-soil plants and are chiefly N. American, the known species being perhaps 90–100. Some of them are S. American, and Bentham & Hooker admit 1 plant which grows in Tasmania. The genus is polymorphous, and there is consequently great difference of opinion as to generic bounds. The marked differences reside in form of caps., character of calyx-tube or hypanthium, and in the habit of the plant. What is by some botanists regarded as 1 genus is broken up into 10 or a dozen genera by others. These genera are here treated mostly as subgenera, for the group is fairly homogeneous from the horticultural point of view, and an entirely new set of names in several strange genera could scarcely be forced on the trade, particularly since the botanists are themselves not in agreement. *Godetia* is kept separate (Vol. III). Some of the true *cenotheras* make glowing displays of yellow in the border; but the

greater number of the species are of only secondary importance to the cultivator. Amongst the best of the border-plant species are *Æ. fruticosa* var. *Youngii*, *Æ. linearis*, *Æ. pratensis*, *Æ. glauca* var. *Fraseri*, *Æ. caespitosa*, *Æ. missouriensis*, *Æ. speciosa*. There are numbers of showy species in the genus, and others than those here accounted for may be expected to appear in cult. In recent years, the genus has assumed unusual interest because of the de Vriesian studies of evolution, founded on the mutations or elementary species in the *Onagra* group.

The *œnotheras* are of wide distribution in North America. They are open-ground sun-loving plants. Many of them are prominent plants of the prairies and plains. Some of them grow on the seacoasts and others in moist ground, but they are not marsh plants. The several widespread field species, the dead stalks of which, with the split upright pods (Fig. 2566), are conspicuous in pastures and on roadsides, are grouped together in current floras under the name *Æ. biennis*, but show great diversity among themselves. They are not ornamental plants, although the flowers that open first are usually rather large and attractive. The plants of the subgenus *Kneiffia* afford the sundrops of gardens; these cultivated plants are not well understood botanically, and it is not unlikely that some of them are hybrids or mutants.

There is nothing special to say about the culture of *œnotheras* except to note the tender kinds and the biennials. All do well in ordinary garden soil, enjoying sunshine. They are easily raised from seeds and cuttings. *Æ. acaulis*, *Æ. caespitosa* are low-growing biennials which do well treated as annuals. They will not endure the winter. *Æ. missouriensis* is an excellent trailer, with enormous yellow flowers and seed vessels. It is quite hardy, and a fine rock-garden plant. *Æ. biennis*, the common evening primrose, is rather weedy, and fit only for the wilder parts of the garden. *Æ. Lamarckiana* is a better form. *Æ. fruticosa* and *Æ. Fraseri* are two of our best border kinds, with stiff branching stems. *Æ. linearis* is a pretty little species, often naturalized but well worth growing. Child's Mexican primrose is tender, but makes a pretty plant for hanging-pots. *Æ. speciosa* is a fine species, but spreads so quickly by underground stems as to become a weed in favorable situations: it is good for naturalizing in wild grounds. (T. D. Hatfield.)

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KEY TO THE GROUPS OR SUBGENERA.

- A. *Stigma capitate or disk-like, entire.*
 - B. *Calyx-tube filiform* I. TARAXIA, No. 1
 - BB. *Calyx-tube short, obovate or funnelform* II. SPHÆROSTIGMA, Nos. 2, 3.
- AA. *Stigma deeply 4-cleft or at least 4-toothed.*
 - B. *Stamens of equal length.*
 - C. *Calyx-tube shorter than the ovary* III. MERIOLIX, No. 4.
 - CC. *Calyx-tube usually much exceeding the ovary.*
 - D. *Seeds angled, horizontal in the pod* IV. ONAGRA, Nos. 5, 6.
 - DD. *Seeds not angled, ascending.*
 - E. *Fls. yellow, erect in bud; seeds in 2 rows in each locule* V. RAIMANNIA, No. 7.

- EE. *Fls. white or pink, drooping in bud; seeds in 1 row* VI. ANOGRA, Nos. 8, 9.
- BB. *Stamens of unequal length.*
 - C. *Plant caulescent (with st.)*
 - D. *Fls. yellow.*
 - E. *Seeds crested* VII. MEGAPTERIUM, Nos. 10, 11.
 - EE. *Seeds not crested* VIII. KNEIFFIA, Nos. 12-16.
 - DD. *Fls. white, pink or reddish* IX. HARTMANNIA, Nos. 17-20.
 - CC. *Plant stemless.*
 - D. *Caps. with wrinkled wing-angles* X. PACHYLOPHUS, No. 21.
 - DD. *Caps. with plane or entire wing-angles* XI. LAVAUXIA, No. 22.

I. SUBGENUS TARAXIA.

Stemless, usually perennial; stigma capitate; calyx-tube filiform: caps. sessile, narrow to ovate, usually not winged; fls. yellow.

1. *ovata*, Nutt. GOLDEN EGGS. Perennial; lvs. slightly pubescent, ovate to lance-oblong, 8 in. or less long, acute, serrulate or entire: fls. yellow; petals about $\frac{1}{2}$ in. long, orbicular; calyx-tube filiform, 3-4 in. long; fl.-bud erect; caps. to 1 in. long, more or less subterranean. Calif.

II. SUBGENUS SPHÆROSTIGMA.

St.-bearing; stigma capitate; calyx-tube short, inversely conic or funnelform: caps. sessile, linear, not winged; fls. various.

2. *bistorta*, Nutt. One to 2 ft., the base decumbent, hairy and pubescent: radical lvs. spatulate to lanceolate and petiolate, dentate; st.-lvs. mostly sessile-ovate to narrow-lanceolate and about 1 in. long, dentate; fls. yellow, turning green, the petals (about $\frac{1}{2}$ in. long) usually with a brown spot at the base; calyx-tube 1-3 in. long; caps. $\frac{3}{4}$ in. or less long, 4-angled, contorted. S. Calif.

Var. *Veitchiana*, Hook. More slender: radical lvs. narrow-oblancoolate and long-petioled: caps. longer and narrower (1-1 $\frac{1}{2}$ in. long) and little contorted. S. Calif. B.M. 5078.

3. *cheiranthifolia*, Hornem. Sts. decumbent or ascending, 2 ft. or more tall, canescent: lvs. thick, about 1-2 in. long, broad-ovate to oblanceolate or the lower ones spatulate, the upper ones becoming sessile, most of them entire: petals yellow, $\frac{1}{4}$ - $\frac{1}{2}$ in. long; caps. $\frac{3}{4}$ in. or less long, curved or spiral, somewhat hairy. Calif. B.R. 1040.

III. SUBGENUS MERIOLIX.

St.-bearing; stigma disk-like but 4-toothed; calyx-tube shorter than the ovary, enlarging upward: caps. linear or nearly cylindrical, sessile; fls. yellow, axillary.

4. *serrulata*, Nutt. (*Merilix serrulata*, Walp.). Biennial or perennial: slender, simple or branched, about 1 ft. high but variable in stature, nearly glabrous to canescent: lvs. linear to lanceolate, 1-3 in. long, usually acute, attenuate to the base, sharply dentate: petals broad-obovate, $\frac{1}{4}$ in. long, wavy-margined. Minn., west and south. Mn. 7:41.

IV. SUBGENUS ONAGRA.

St.-bearing; stigma 4-cleft; calyx-tube elongated and cylindrical, enlarging at the throat: caps. linear-oblong to long-conic, 4-angled; fls. yellow, opening in evening.—TRUE EVENING PRIMROSES, comprising a mutating group.

5. *biennis*, Linn. (*Onagra biennis*, Scop.). EUROPEAN EVENING PRIMROSE. Fig. 2566. Usually biennial, but often flowering the first year: mature rosettes of plants grown in rich soil 2 ft. diam.: roots large and fleshy, often 2 in. diam. at the crown: st. about 3-4 ft. tall, copiously branched, green: lvs. varying from narrowly oblanceolate below to ovate above: calyx-tube

nearly 1½ in. long; unopened bud an inch long or less; petals obcordate, broader than long, 1 in. wide; stigmas surrounded by the anthers and self-pollinated in the bud; caps. 1 in. long, loosely aggregated in the lower part of the spike, more densely above, shorter than the subsistent leafy bracts.—Intro. into Eu. from Amer., and now a common weed in the Old World. Gn. 26, p. 480.—It is somewhat coarse and has little to recommend it to cult., although it is larger-fl. and more beautiful than the common American plants, which, although they are different from the species here described, pass under the name *E. biennis*. In France and other European countries, the roots of *E. biennis* are said to be used as a vegetable, after the manner of salsify or oyster plant. The root should be eaten, according to Vilmorin, "at the end of the first year of its growth." *E. biennis* is now unknown as a wild plant in Amer., although it will probably be found among the numerous locally distributed forms which have not yet been adequately studied. A number of obscure kinds pass in Amer. under the name *E. biennis*. Most of them are more weedy than the European species and the roots are generally woody and tough. A var. *hirsutissima* (*E. franciscana*, Bartlett) is offered in Calif., described as having sts. stout and reddish; lvs. hairy, light green, lanceolate; fls. large, bright yellow.



2566. Capsules of evening primrose—*E. biennis*, as known in North America. (×½)

Var. *grandiflora*, Lindl. (*E. grandiflora*, Ait.). Plant large and strong: lower lvs. often pinnatifid; fls. much larger, the petals 1-2½ in. long; buds glabrous and usually red-spotted. B.M. 2068. B.R. 1604. Gn. 26, p. 482; 46, p. 64.—Very showy when the fls. open. Commoner southward. Seeds sold under this name are usually the next species.

6. *Lamarckiana*, Hort. Differs from the above in its densely red-tuberculate sts., broad crinkled lvs. and much larger fls.: the stigmas are longer than the stamens and are pollinated by insects after the buds open: the buds are densely pilose and viscid: the fls. open suddenly about dusk and are immediately visited by the sphinx moths.—This species is unknown in the wild state. It is suspected by some of having had a horticultural origin, but by others considered more probable that it is a wild species which will yet be rediscovered in its native region. It has become the subject of an enormous literature, due to de Vries' discovery that it gives rise to distinct true-breeding derivatives (mutations) in every generation. These mutations are considered to throw light on the vexed question of the origin of species and horticultural varieties. The most interesting of them are a giant form, *E. gigas*, and a dwarf, *E. nanella*. Others are *E. rubraurvis*, *E. lata*, *E. brevistylis*, and *E. oblonga*, whose names suggest the characters in which they differ from the parent species. They are cult. in most botanic gardens, but are not offered by the trade. *E. Lamarckiana* closely resembles several beautiful species of the W. which have not been intro. into cult. *E. rubricalyx*, Gates, is a derivative of *E. Lamarckiana*, from which it differs in having the calyx-tube and segms. a fine rich red. G.C. III. 53:165. It is the only one of the mutations referred to above which has been intro. into general cult. It is known to the trade as "Sutton's Afterglow."

V. SUBGENUS RAIMANNIA.

St.-bearing: stigma deeply 4-cleft; calyx-tube very long and filiform or linear: caps. narrow-cylindric, obtusely 4-angled, with numerous seeds in 2 rows in each locule: fls. yellow, mostly showy.

7. *Drummondii*, Hook. One to 2 ft., from an oblique or decumbent base, densely soft-pubescent; lvs. lance-oblong or oblanceolate, acute or obtuse, either gradually or abruptly tapering into a short petiole, entire or slightly toothed; calyx-tube usually 2 in. long and very narrow; fls. 2-3 in. across, nocturnal, bright yellow, showy; caps. 1-2 in. long. Texas coast. B.M. 3361.—Perhaps biennial, but grown as an annual.

VI. SUBGENUS ANOGRA.

St.-bearing: stigma deeply 4-cleft; calyx-tube elongated and enlarging upward: caps. oblong or linear: fls. white or pink, opening by day.

8. *albicaulis*, Pursh (*E. pinnatifida*, Nutt. *Anagra albicaulis*, Brit.). Annual or biennial, low (1 ft. or less tall), sts. white and shreddy, the branches ascending, slightly pubescent or sparsely hairy; lvs. lanceolate, oblanceolate or lance-oblong, deeply pinnatifid or some of the larger ones only strongly toothed, 4 in. or less long, sessile or nearly so; fls. large (3 in. or less across), diurnal, white and fading to rose, the petals obcordate. Prairies, west.

9. *californica*, Wats. (*E. albicaulis* var. *californica*, Wats.). Smaller and hoary-pubescent or villous, the sts. only 3 or 4 in. long, ascending from a rootstock:



2567. One of the sundrops—*E. linearis*. (×½)

lvs. narrow-oblongate and acuminate, usually stalked, toothed or pinnatifid: fls. often larger, fragrant, the petals lobed. Cent. and S. Calif.

VII. SUBGENUS MEGAPTERIUM.

St.-bearing: stigma 4-cleft; calyx-tube very long and slender, enlarging at the top: caps. very broad and strongly 4-winged: fls. yellow, showy.

10. *missouriensis*, Sims (*Æ. macrocarpa*, Pursh. *Megapterium missouriensis*, Spach). Low perennial with a hard base, the ascending sts. mostly not over 1 ft. long, usually pubescent: lvs. thick, varying from oval to linear to narrow-lanceolate, 5 in. or less long, acuminate, narrowed to a petiole, entire or remotely denticulate: petals 1-2½ in. long, very broad, yellow: caps. 2-3 in. long and nearly as wide, broad-winged. Mo. and Neb., west and south. B.M. 1592. Gn. 26, p. 480. R.H. 1857, p. 598.

11. *Havardii*, Wats. Sts. numerous, short, slender and simple or branching, rising from a branching caudex, the plant canescent: lvs. linear-lanceolate in a rosette, narrowed toward either end, sinuate-pinnatifid: fls. sessile, the buds erect, the calyx-tube with coherent tips; petals ½-1 in. long, yellow turning red: caps. oblong-ovate, 4-angled and ribbed. Texas.

VIII. SUBGENUS KNEIFFIA.

St.-bearing: stigma deeply 4-lobed; calyx-tube very slender, somewhat dilated at the top: caps. rather small, club-shaped, 4-angled or narrowly 4-winged: fls. yellow, diurnal.

A. *Plant more or less glaucous, glabrous.*

12. *glauca*, Michx. (*Kneiffia glauca*, Spach). Erect perennial, 2-3 ft.: lvs. ovate to ovate-oblong, 4 in. or less long, acute or somewhat obtuse, sessile, remotely denticulate: fls. large, in short leafy clusters, the calyx-tube about ¾ in. long; petals an inch long, more or less emarginate: caps. oblong, broad-winged, short-stalked, Va., Ky., and south. B.M. 1606. Var. *Fraseri*, Torr. & Gray (*Æ. Fraseri*, Pursh), is a form with ovate-lanceolate often slightly petioled lvs. Southern states. B.M. 1674.

AA. *Plant not glaucous, usually hairy or pubescent.*

B. *Caps. smooth, or bearing slight gland-tipped hairs.*

13. *fruticosa*, Linn. (*Kneiffia fruticosa*, Raim.). SUNDROPS. Perennial (or sometimes biennial), erect and more or less branchy, rather stout, 1-3 ft. high, the terete usually reddish sts. somewhat villous: lvs. ovate to narrow-lanceolate, 3 in. or less long, firm, usually acute, remotely denticulate or entire, mostly sessile: fls. 1½-2 in. across and showy, in an elongating cluster, with linear bracts: caps. oblong to obovate, short-stalked or sessile, strongly winged. Dry soil, Nova Scotia, south and west. B.M. 332.—Very variable. Var. *Youngii*, Bailey (*Æ. Youngii*, Hort.), is common in cult., and is prized for its stocky growth and profusion of bloom. It is a strong larger-lvd. plant, with firm shiny slightly glaucous foliage, and bearing many bright lemon-yellow fls.: 2 ft., much branched and somewhat decumbent at base. Excellent. Var. *majör*, Hort., is a strong-growing floriferous form, forming a dense bush-like specimen.

14. *pumila*, Linn. (*Kneiffia pumila*, Spach). SUNDROPS. Slender erect biennial or perennial, 1-2 ft. high, simple or branched: lvs. oblanceolate or oblong, usually glabrous, entire, the radical spatulate: fls. an inch or less across in a loose, leafy spike or raceme, the calyx-tube shorter than the ovary, the petals obovate: caps. mostly clavate, short-stalked or sessile. Newfoundland, south and west. *Æ. Pilgrimii*, Hort., appears to belong with this species. It is very like *Æ. fruticosa* var. *Youngii* horticulturally, but in established plants it is apparently somewhat taller and more branching, and

the fls. not so large and color not so deep; it may be an offshoot of *Æ. fruticosa*.

BB. *Caps. grayish pubescent, the hairs glandless.*

15. *linearis*, Michx. (*Æ. fruticosa* var. *linearis*, Wats. *Kneiffia linearis*, Spach). SUNDROPS. Fig. 2567. Slender, 12-20 in. high, biennial or perennial, pilose, puberulent or nearly glabrous: basal lvs. spatulate to broad-oblongate; st.-lvs. linear to narrow-lanceolate: fls. bright clear yellow, 1½ in. or more across, standing well above the foliage lvs.; petals obovate and notched or emarginate at apex: caps. mostly less broadly winged, clavate. Conn., south. Gn. 26, p. 481.—In cult., this is a neat and bright little plant, blooming in July. The plant known in gardens as *Æ. fruticosa* var. *pallida* probably belongs with this species or with the form of it sometimes separated as *Kneiffia Allenii*, Small.



2568. A sundrop—*Enothera pratensis*. (× ½)

16. *pratensis*, Rob. (*Kneiffia pratensis*, Small). Fig. 2568. SUNDROPS. A day-blooming perennial, 1-3 ft. high, making a good clump and frequently planted in yards: sts. sometimes branched above, with soft-spreading hairs: lvs. oblong-lanceolate to elliptic-lanceolate, hairy, entire or sinuate, acute or obtuse: fls. bright yellow, leafy-bracted, mostly clustered at top of st.; tips of calyx hirsute; petals ½-1 in. long, obovate: caps. club-shaped, hispid, sessile or nearly so. Maine to Iowa and Ark.—A good hardy plant for early summer to midsummer bloom.

IX. SUBGENUS HARTMANNIA.

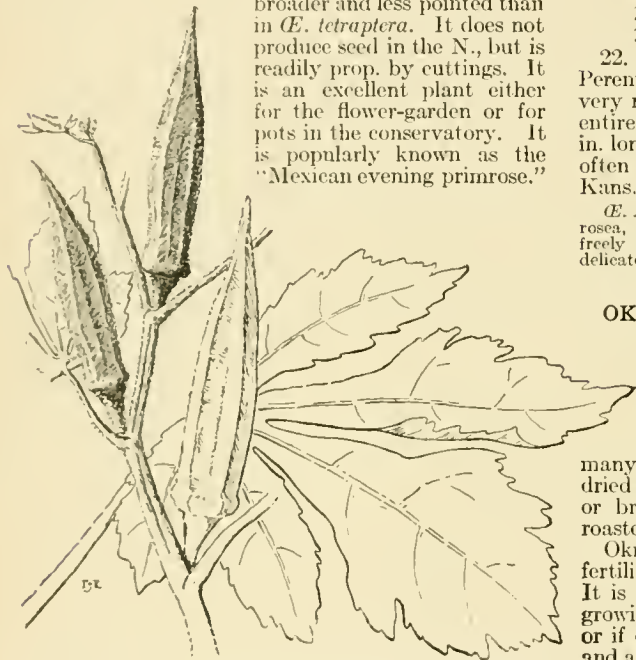
St.-bearing: stigma 4-lobed; calyx-tube funnelform, often very long: caps. club-shaped or obovate, broad-winged: fls. white, pink or red, diurnal. (Including Xylopleurum, etc.).

A. *Plant canescent or villous, usually erect, or at least prominently ascending.*

17. *speciosa*, Nutt. (*Hartmannia speciosa*, Small). Perennial, with a rootstock, erect or ascending branches, 2 ft. or less high, canescent: lvs. linear to lance-oblong, 4 in. or less long, remotely or sinuately dentate, or the

lower ones pinnatifid, attenuate at base; calyx-tube as long as the ovary; petals large, obovate, white; caps. $1\frac{1}{2}$ – $\frac{3}{4}$ in. long, 8-winged, acute at top. Mo., west and south. B.M. 3189. Gn. 26, p. 482.

18. *tetraptera*, Cav. (*Hartmannia tetraptera*, Small). Villous; caps. larger and more broadly winged, very abruptly contracted at top; calyx-tube shorter than the ovary; fls. white, becoming rose. Texas and Ariz., south. B.M. 468. Var. *Childsii*, Bailey (*E. rosea mexicana*, Hort.), is a handsome form intro. from Texas by John Lewis Childs in 1892. It was found in the wild. "We first secured the pink," Childs writes, "and afterwards someone else sent us the white, blush and the other shades, all from Texas." In some respects it differs markedly from *E. tetraptera*, and it is not impossible that it is a distinct species. In cult. it is a trailing plant. The lvs. tend to be broader and less pointed than in *E. tetraptera*. It does not produce seed in the N., but is readily prop. by cuttings. It is an excellent plant either for the flower-garden or for pots in the conservatory. It is popularly known as the "Mexican evening primrose."



2569. Okra. The pods of okra vary greatly in length, depending on the variety, up to 10 and 12 inches; they are usually 4 to 6 inches long. ($\times \frac{1}{2}$)

19. *rosea*, Ait. (*Hartmannia rosea*, Don). Root biennial or perennial; st. erect or ascending, 1–2 ft., branching from the base; lvs. lanceolate to narrow ovate-lanceolate, mostly acuminate, rather abruptly narrowed to a petiole, entire or remotely denticulate or the larger ones small-lobed at the base; calyx-tube shorter than the ovary; fls. small, fuchsia-like, purple or rose, the petals rounded and entire; caps. much like that of *E. speciosa*. Texas and New Mex., south. B.M. 317.

AA. Plant glabrous or essentially so, nearly stemless or else prostrate.

20. *acaulis*, Cav. (*E. taraxacifolia*, Hort.). Tufted perennial or biennial plant, at first stemless, but producing prostrate, somewhat zigzag sts.; lvs. oblong in outline, 5–8 in. long, petioled, divided into many unequal narrow divisions (like a dandelion lf.); fls. usually opening white, but changing to rose, large (2–3 in. across), the very slender tube 3–5 in. long; caps. short-obovate, broadly triangular-winged above. Chile. B.R. 763. Gn. 26, p. 180.—A very interesting and attractive plant.

X. SUBGENUS PACHYLOPHUS.

Stemless or essentially so; stigma 4-cleft; calyx-tube very slender but enlarging upward, longer than the ovary; caps. with wrinkled or contorted wings; fls. white or pink.

21. *cæspitosa*, Nutt. (*Pachylophus cæspitosus*, Spach). Crown 2–4 in. high, perennial or biennial; lvs. clustered, oblong to narrow-lanceolate or spatulate, sometimes 1 ft. long, attenuate, repand-toothed, pubescent; fls. white or pink, $1\frac{1}{4}$ –3 in. across, the petals obovate; calyx-tube 2–6 in. long; caps. oblong-pointed, 1–2 in. long. S. Dak., Neb., west and south. B.M. 1593, 5828 as (*O. marginata*). Gn. 26:480; 47, p. 46 (both as *O. marginata*).

XI. SUBGENUS LAVAUXIA.

Stemless or essentially so; calyx-tube very slender, enlarging upward, longer than the ovary; caps. with plane or entire wings; fls. white, pink, or even pale yellow.

22. *brachycarpa*, Gray (*Lavauxia brachycarpa*, Brit.). Perennial, densely pubescent; lvs. thickish, ovate to very narrow-lanceolate, about 6 in. long, long-stalked, entire or notched or lyrate-pinnatifid; calyx-tube 2–3 in. long; petals about $1\frac{1}{2}$ in. long, purplish; caps. ovate, often 1 in. long, the wings not wrinkled. Mont. to Kans., west and south.

E. Arendsii, Bowles. Said to be a hybrid of *E. speciosa* and *E. rosea*, ("*E. speciosa* var. *rosea*") harder than the former; spreads freely from the base, blooming on the young shoots; fls. large, delicate shade of pink with white eye. Gn. 76, p. 638.

L. H. B.

OKRA, or GUMBO (*Hibiscus esculentus*) is a half-hardy plant introduced into United States and West Indies from Africa, and cultivated for its fruit-pods, which are used in soups, stews, catsups, and the like (Fig. 2569). In soups and catsup, it gives body to the dish; stewed, it is mucilaginous, and while at first not agreeable to many persons, a taste for it is easily acquired. It is also dried and canned for winter use. When ripe, the black or brown white-eyed globular seeds are sometimes roasted and used as a coffee substitute.

Okra should be sown in a dry warm soil, of medium fertility and texture, after danger of frost has passed. It is important to select the correct type of land for growing okra. It should be a well-drained sandy loam, or if clay only is available it should be a loamy clay, and a soil that is not likely to become water-logged during the rainy weather. The soil should be prepared deeply and thoroughly, the deeper the better, if the soil is good. The rows should be made 3 to 5 feet apart, according to variety, and seeds dropped about 2 inches apart in the row; cover 1 or 2 inches deep. After plants are 6 inches high, thin to 1 foot apart for dwarf varieties and to about 3 feet for the largest varieties. After the plants have been cut out to a proper stand in the row, frequent cultivation should be given. This is best performed with implements that cut rather deeply. The okra plants do not throw out many lateral roots in the early stages of growth if planted on the proper kind of soil. The seedlings transplant with considerable difficulty, so they need to be started in flower-pots if an extra-early crop is desired. The pods must be gathered before the fiber develops in them: the size will vary with the variety, but if it is too "stringy" to cut with a dull case-knife it is too old. Keep all old pods cut off. The dwarf varieties are in greater favor in the South because of their habit of bearing early. A plant, constantly cropped, remains in bearing condition until frost kills it, but allowed to retain pods it suspends growth until the seeds have matured, when a second growth may take place. Okra will grow for years if not killed by frost or other adverse conditions, i. e., it makes an indeterminate growth like cotton, malva, hibiscus, and the like. For shipping, cut the stems

(peduncles) an inch or so long so as to prevent wilting in transit. Pack firmly in vegetable crates. The demand for this vegetable is increasing, especially in New York City. Seed is easily grown and saved. The plant is subject to several diseases to such an extent that it is impracticable to raise a crop on certain pieces of land. Rotation is the best remedy.

P. H. ROLFS.

OLAX (probably from the odor or smell). *Oleaceæ*. Thirty and more species of trees, sometimes scandent, shrubs and subshrubs in the tropical parts of the Old World, little known in cult.: lvs. alternate, simple: fls. white or whitish, sometimes colored, small, mostly in short axillary simple or branched racemes; calyx cup-shaped, minute; petals 3-6, some of them in some species coherent; fertile stamens usually 3, sometimes 4 or 5, mostly standing opposite the edges of the petals; staminodia 5 or 6, notched, mostly standing opposite the petals; ovary free, in a cup-shaped disk, the stigma 3-lobed: fr. somewhat immersed in fleshy calyx, containing a 1-seeded stone. None of the species seems to be listed; probably some of them would be interesting for S.

L. H. B.

OLDENBURGIA (S. Oldenburg, a collector for Kew in 1772-3). *Compósitæ*. Three species of remarkable S. African stocky shrubs or subshrubs, with woolly rootstocks, and large solitary heads of purple corollas. They are not in general cult., but may be expected in some of the botanical collections: lvs in a rosette, coriaceous and 1-nerved, very hairy underneath: fls. all perfect in the head, the outer ones radiate; scales of involucre linear, acuminate, not spiny; achene beakless, with a pappus of many plumose bristles. *O. Arbuscula*, DC., has flowered in recent years in England (at Kew the plant was 3 ft. high and unbranched at 16 years): lvs. crowded at ends of branches, obovate or oblong, to 18 in. long, at first white-woolly: fl.-heads often 1 ft. across, purple and white. B.M. 7942. G.C. III. 35:9.

L. H. B.

OLDENLÂNDIA (H. B. Oldenland, Danish botanist, of the 17th century). *Rubiaceæ*. More than 200 species of shrubs, subshrubs and herbs in many parts of the world, mostly tropical, of little value horticulturally. Fls. small, most inconspicuous, white or rose-colored, rarely solitary but mostly in dichotomous panicles; calyx mostly 4-toothed; corolla usually 4-toothed, rotate, funnel-shaped or salver-shaped; stamens mostly 4, inserted in the throat of the corolla: fr. a small caps. adnate to calyx-tube, dehiscent at top: lvs. opposite, mostly small and narrow. A few annual or perennial species are native in N. Amer., being small plants of no prominence.

L. H. B.

OLDFIELDIA (from R. A. Oldfield, a merchant at Sierra Leone). *Euphorbiaceæ*. Evergreen tropical tree rarely cult. in greenhouses: lvs. opposite, digitately compound; lfts. 5-7, entire, coriaceous, pinnately veined: fls. dioecious, apetalous, in short axillary clusters; stamens 4-10; ovules 2 in each cell. Related to *Bischofia*. One species in Trop. Afr., *O. africana*, Hook., is said to yield the African oak, or African teakwood, sometimes exported. It may be grown from cuttings in loam, leaf-mold and sand and should be well watered when growing rapidly.

J. B. S. NORTON.

OLD MAN. Another name for the southernwood, *Artemisia Abrotanum*; also for the rosemary, *Rosmarinus officinalis*; and probably for various hoary plants. *Artemisia Stelleriana* is said to be known sometimes as Old Woman.

OLD-MAN-AND-WOMAN, or common houseleek: *Sempervivum tectorum*.

OLD MAN CACTUS: *Pylæococcus senilis*.

OLD MAN'S BEARD. In Europe, *Clematis Vitalba*; in America the common wild clematis, *C. virginiana*; also *Saxifraga sarmentosa*; rarely the fringe tree, *Chionanthus*.

ÔLEA (classical name for olive). *Oleaceæ*. OLIVE. The olive tree and fruit; and other small trees or shrubs of little importance in cultivation. (The *Olea fragrans* of greenhouses is *Osmanthus*; also *O. Aquifolium*.)

Spiny or unarmed: lvs. evergreen and thick, opposite, usually entire, and often rusty-tomentose beneath: fls. small, usually imperfect, white or whitish, in forking panicles or fascicles, the short calyx 4-toothed (corolla sometimes none), the short-tubed corolla with 4 valvate lobes, the stamens 2; ovary 2-loculed, bearing a short style and capitate stigma: fr. an oblong or ovoid drupe.—Between 30 and 40 trees or shrubs of the tropical and warm-temperate parts of the Old World to New Zeal.

europæa, Linn. Small tree, rarely exceeding 20 or 25 ft. in height, and bearing small oblong or lanceolate lvs. and axillary forking racemes of yellowish white fragrant fls. It is probably native to the E. Medit. region or W. Asia, but has been in cult. from the earliest times and is spontaneous in parts of S. Eu.

Var. **Oleaster**, DC. (*O. Oleaster*, Hoffm. & Link. *O. sylvestris*, Mill. *O. europæa* var. *sylvestris*, Rouy). The wild form: thorny, the branches 4-angled or -cornered: lvs. elliptic or oblong: fr. small, roundish, inedible.

Var. **communis**, Ait. (*O. gallica*, Mill. *O. officinarum*, Crantz. *O. lancifolia*, Moench. *O. sativa*, Hoffm. & Link. *O. europæa* var. *sativa*, DC.). The cult. olive, a handsome gray-green tree, with thornless terete or only obtuse-angled branches: lvs. lanceolate, willow-like in shape: fr. size of a damson or larger, nearly globular to oblong. See *Olive*.

chrysophylla, Lam. Small tree, noteworthy because of the drab or golden color of the under surface of the lvs.: branchlets slender, lepidote or scurfy upward: lvs. lanceolate, 2-4 in. long, the petiole very short: fls. small (corolla 1/4 in. long), in axillary panicles: drupe rather large and blackish, globose or somewhat long. Trop. Afr.—It has been intro. to cult. in S. Calif.

L. H. B.

OLEANDER: *Nerium Oleander*.

OLEARIA (J. G. Olearius, who published a flora of Halle, 1668). *Compósitæ*. TREE-ASTER. Shrubs and trees of Australia and New Zealand, allied to Aster, somewhat planted abroad, but apparently not tested in this country.

The tree-asters are of more than 100 species, evergreen, with white, blue or purple rays, many of which are worthy of cult.: lvs. alternate, or sometimes opposite or fascicled, mostly tomentose beneath: heads various in size, solitary or clustered, sometimes rayless, the involucre with several rows of bracts that have scarious or dry margins; ray-florets female, in a single row; disk-florets perfect: achene terete or somewhat compressed, bearing one or more rows of pappus bristles. Some of the New Zealand species have large usually solitary fl.-heads and stiff lanceolate toothed lvs., which should be tested in Amer.; Cockayne writes that they require a moist equable climate with low summer temperature, and are not suited to ordinary garden conditions. Speaking of the New Zealand olearias in general, of which there are more than 40 species, Cockayne says that all are well worthy of cult.; some are alpine and subalpine; some are both trees and shrubs, others shrubs alone.

Haastii, Hook., long known in south of England as a good late summer- and autumn-blooming shrub and apparently the only one that has been regularly offered in this country: in New Zeal., where it is native (in the south island), a shrub 4-8 ft. high, with hoary branches:

lvs. alternate, oblong, elliptic or oblong-ovate, $1\frac{1}{4}$ in. or less long, shining above and tomentose beneath; heads small and numerous, containing 8-10 florets, and 3-5 short broad white rays. B.M. 6592. G.C. III. 20:533. Gn. 38, p. 149; 78, p. 473. J.H. III. 68:265. F. 1874, p. 198. R.H. 1913, pp. 495, 497.

Other recent accessible portraits of olearias as cult. plants are: *O. chathamica*, Kirk, G.C. III. 53:363; *O. Forsteri*, Hook. f., G. 35:515; *O. insignis*, Hook. f., G.C. III. 57:333. Gn. 79, p. 301. G. 37:283. *O. macrodonta*, Baker, G. 35:413, 415; *O. myrsinoides*, Muell., Gn. 77, p. 58, the Australian daisy-bush blooming in England in June; *O. nitida*, Hook. f., G.M. 56:692. G. 35:757; *O. semidentata*, Deene., B.M. 8550; *O. stellulata*, DC. (*O. Gunniana*, Hook. f.), B.M. 4638. Gn. 78, p. 350. R.H. 1913, p. 547.

L. H. B.

OLEASTER: *Eleagnus angustifolia*; also *Olea*.

OLFÉRSIA (after Ignaz Offers, a German consul at Rio Janeiro). *Polyodiaceæ*. A genus of one species related to *Polybotrya*, formerly classified with *Acrostichum*. Fertile and sterile lvs. dissimilar, the sterile 2-pinnate, the fertile 3-pinnate, with the sporangia in masses completely covering the backs.

cervina, Kunze. A showy large fern adapted for cult. on palm trunks, and the like: rootstock creeping, densely clothed with long narrow scales, the lvs. 3-6 ft. long, 10-20 in. broad, coriaceous, with prominent veins which unite at the margins. R. C. BENEDICT.

OLIGOBÔTRYA (*few clusters*). *Liliacææ*. One species, in China, intermediate between *Smilacina* and *Polygonatum*. It is an erect herb, 3 ft. and more tall, adapted (in England) to a shady moist border such as is suited to hardy cypripediums. *O. Henryi*, Baker, is the species: lvs. ovate-oblong or ovate, alternate, sessile or short-stalked, many-nerved, pubescent, about 4 in. long; fls. white or pale yellow, in terminal simple or branching racemes; perianth-tube cylindric, $\frac{1}{2}$ in. long, the 6 broad lobes shorter and spreading; stamens joined to throat of corolla, the filaments very short; ovary ovoid, the stigma 3-lobed. B.M. 8238. Var. *violacea*, C. H. Wright, has a violet perianth-tube and paler lobes. B.M. 8238.

OLIVE. A small evergreen tree grown for its drupes which yield oil and are also prepared as a food and condiment.

The cultivated olive (*Olea europæa*) is the typical species of the genus *Olea* (Fig. 2570). It is found growing wild in various countries from the Punjab to Morocco and the Canary Islands and on both sides of the Mediterranean from the slopes of the Atlas to southern France and

Macedonia where moisture and temperature conditions are favorable. It is particularly abundant in Syria and Algeria. The wild form has small rigid leaves and a fruit with little flesh and is sometimes considered as a distinct botanical variety under

the name of oleaster or *Olea sylvestris* (see *Olea*). It is used as a stock on which to graft the cultivated forms and in Algeria the government encourages the utilization of wild trees by grafting in place (Fig. 2571).

The cultivated olive is grown throughout the same region and, with the aid of irrigation, in localities too dry for its naturalization. It has been grown from prehistoric times in Asia Minor where it seems to have originated. Its culture was introduced into all Mediterranean countries by the Phœnicians, Greeks, and Romans. In modern times it has been widely dispersed by colonists in America, Australia, and South Africa.

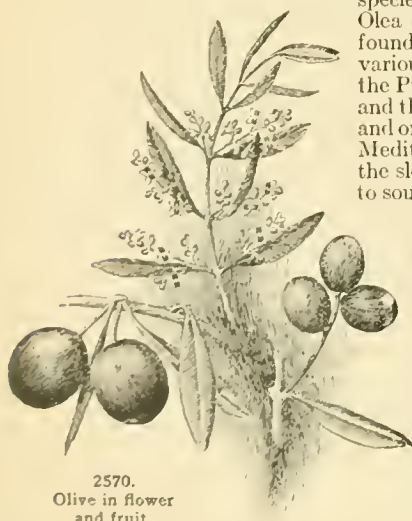
In the United States the olive succeeds only in California and in parts of Florida, Arizona, and New Mexico. It was planted at the missions by the Franciscan padres and from the trees grown there came the variety now known as the Mission, which is still preferred to all other varieties by most growers. The original trees were grown at the San Diego Mission from seeds brought from Mexico. Like the Mission grape, the Mission olive has not been identified with any Old World variety and is probably a seedling. Some growers distinguish several forms or variations of the Mission, differing in size and form of leaf, fruit, and tree. The correctness of this view seems probable from the mode of its origin, but others consider these differences to be due simply to variations of soil and climate.

The olive thrives in all soils providing they are deep and well drained, but the crops are in proportion to the fertility of the soil. The olive will often make a handsome vigorous tree in dry situations unsuited to most fruits, provided the subsoil will allow of deep penetration of the roots. Paying crops are obtained, however, only on fairly fertile soil and with intelligent and thorough cultivation. It requires a slightly greater annual sum of heat than the vine and is more sensitive to winter cold, which should never fall below 14° F., nor frequently below 19° F. A clear dry atmosphere is favorable. Summer rains or fogs render the tree subject to the attack of the black scale, which is very harmful and difficult to control on the olive.

Suitable situations and paying orchards are found in California from the upper end of the Sacramento Valley to the borders of Mexico in Imperial County. Most of the paying orchards are on the slopes of the Sierras at moderate elevations, in southern California, and widely scattered through both the Sacramento and the San Joaquin valleys. There are a few good orchards in favored locations in the inner coast valleys from Sonoma southward. Olive-growing promises to be very successful in the Imperial Valley.

The suitability of California for olive-growing began to be generally recognized between 1880 and 1890 and many orchards were planted during this period. The expectations of large profits were not as a rule realized when the trees came into bearing. Several causes contributed to this. The oil could not compete with the cheap cottonseed oil which was often sold as "pure olive oil;" the ripe pickled olives were a novelty and their merits not understood in the East and the first attempts to manufacture green pickled olives were unsuccessful. Many orchards were accordingly uprooted and few trees were planted during the next fifteen years. Recently effective pure-food laws have removed much of the competition of imported and domestic cottonseed oil, the taste for ripe pickled olives has been acquired by a large body of consumers and the methods of producing green pickles have been perfected. Few of the last, however, are made, as the demand for good ripe pickles exceeds the supply. Olive-growing has therefore been on a profitable basis for some years and large new plantations have been made during the last five years.

No reliable statistics of the olive industry are available but the statistician of the California State Board of Agriculture places the number of trees in California



at 1,530,000 which corresponds to something under 30,000 acres. The same authority credits Florida with 8,000 trees, Arizona with 1,600 and all other states with 200. The State Board of Equalization, however, placed the number of trees in California in 1912 at only 700,000, or about 14,000 acres.

It is estimated that California produced in 1910 about 800,000 gallons of olive oil and 1,000,000 of pickled olives. For 1911, the oil output is placed at 920,000



2571. Arab family gathering fruit of grafted wild olive in Algeria.

gallons and the pickles at 1,150,000 gallons. If one ton of olives is reckoned to yield thirty-five gallons of oil and that it requires six pounds of olives to make one gallon of pickles, the crop of 1911 represents about 31,000 tons of fruit, of which 85 per cent were used for oil and only 15 per cent for pickles. If the average of the estimates of total acreage given above is taken, the crop is equivalent to 1.4 tons to the acre. When it is considered that many orchards are planted with poor bearing varieties and in unfavorable situations, this average is satisfactory.

According to the state statistician, six counties of the San Joaquin and Sacramento valleys produced in 1900 nearly 75 per cent of the crop of the whole state, though having but 25 per cent of the trees. This indicates a variation of crop of less than half a ton to over four tons to the acre, according to locality. In the south of France 2.7 tons to the acre is considered a maximum yield and good well-cultivated orchards are not expected to average more than 1.3 tons.

Using the estimates given above, it will be seen that pickles were made from only about 15 per cent of the crop, the remainder being used for oil. The reason for this is that while pickled olives of suitable quality are more profitable than oil, only the large olives are acceptable to the market. During the first period of heavy planting, a large number of the trees used were of varieties suitable for oil, which are all of small or medium size. Even when large-fruited varieties are planted, there will always be a large proportion of the fruit undersized, especially in poor soil and in unfavorable localities. At present the tendency is to plant only those varieties which are capable of producing large fruit but which at the same time are rich in oil of good quality. The pickled olive is thus considered the

main crop and the oil a kind of supplementary or by-product. From this point of view, the Mission olive, when propagated from selected trees in favorable localities, is perhaps the best variety. Pickling and oil-making tend to concentrate in large central establishments in each olive-growing center. This makes it possible to employ the best methods and machinery in the hands of trained men. The results are great improvement in quality of the product and economy of operation.

The price paid for olives fell at one time to \$15 a ton which, with the average crop, represents gross returns of \$25 or \$30 an acre, which in most cases would not pay the cost of cultivation and harvesting. It has risen gradually until during the last few years \$100 a ton has been paid for olives suitable for pickling and even \$150 to \$200 a ton for very large fruit. This represents average gross returns of about \$150 or more to the acre and is very profitable, as the large olives are gathered much more cheaply than the small. When turned into pickles, a ton of olives represents \$250 at the low retail price of 75 cents a gallon, but a ton of olives will yield oil of a value of only about \$87.50 at the ordinary price of \$2.50 a gallon. As olives are usually bought ungraded, the buyer of pickling olives at present prices incurs a loss on all the small olives he uses for oil. The price paid for oil olives too small for pickling is less than half that paid for the large fruit.

Propagation.

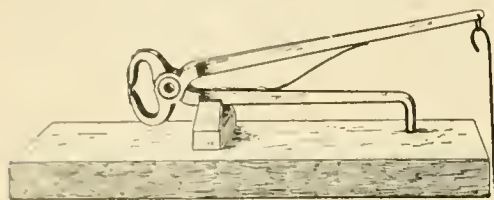
Olives in California are usually grown from cuttings taken from the tree when it is most dormant, that is, in January and February. These cuttings may be of any size and taken from any part of the tree. Most nurserymen prefer to use "tips." These are the mature ends of shoots 4 to 5 inches long. Two or three of the upper leaves are left or trimmed back a little and the remainder removed entirely. They are then planted in boxes of sand under glass with artificial heat and, after rooting, transplanted to the nursery where they remain for one, two or three years before being planted in place. When a greenhouse is not available, larger cuttings of older wood are preferable. These cuttings are usually made about 14 inches long and may be from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in diameter. Their rooting may be facilitated by splitting or scratching the bottom 2 or 3 inches with a knife. In Spain, large branches of old trees are used to produce young plants. These branches (truncheons) are cut into convenient lengths and incisions reaching half way to the center made every 3 or 4 inches. The sections are then placed horizontally in trenches about 10 inches deep, where they are covered with soil, and watered. Shoots arise near the saw-cuts and when sufficiently developed they are removed with the roots which have formed, and planted in the nursery. This method, formerly employed in California, is now little used there. Suckers taken from the base of the trunk with a plate of the old wood attached to the base are sometimes used and root more easily than ordinary cuttings.

Olives may also be propagated by seeds, which are supposed to give a stronger root-system and more fruitful trees. The seedlings, however, must be grafted and it takes a little longer to obtain a tree by this means.

The Mission and many other cultivated varieties have large seeds which are hard to germinate. Small-fruited varieties, such as the Redding and Chemlali, which resemble the wild olive, are the best. The completely ripe olives are placed in a heap until the pulp becomes soft enough to be removed easily. Usually the stones are then treated for twelve to twenty-four hours in a 10 per cent solution of caustic soda. The process must be carefully watched by breaking a stone occasionally and the lye removed before it penetrates to the kernel. The treated pits are kept in moist sand until March or April, when they are planted thickly in close

rows. Many will not germinate the first year and many not at all.

Much time may be saved by clipping off the apex of the olive pit. Seeds treated in this way will germinate readily in a few weeks. By means of a simple device originated by the California Experiment Station, this clipping can be done very rapidly (Fig. 2572).



2572. Device for clipping olive seeds.

The second or third year, the young seedlings are transplanted to nursery rows in good rich soil, where they are budded or grafted the following spring. One or two years later, they are ready to be planted in the orchard.

The planting distances vary with the nature of the soil and of the variety. The trees in some orchards are planted as near as 20 feet, but more at 21 to 30. The olive is very long in reaching its full size, and some growers plant at 20 or 24 feet with the intention of taking out three-quarters of the trees when they begin to crowd, leaving them 40 to 48 feet apart. It is not, however, until the trees are twenty-five or thirty years old that they reach full size, and most growers prefer to plant at intermediate distances of about 30 to 36 feet. In France, the distances adopted vary from 15 feet in the most northerly districts to 24 feet in the more southerly. In Algeria, from 30 to 36 feet are the usual distances, while in Tunisia 45 feet and even 60 to 72 feet are adopted, usually with intercalary annual crops. Most of the olives in California are planted in solid orchards, but many are used as avenue and border trees.

Seedling olives are grafted in the nursery. This may be done when the seedlings are one year old, by means of a side- or whip-graft in early spring, or of a twig-bud after the sap is flowing freely. The graft is made at or near the surface of the ground. Older seedlings may be crown-grafted or twig-budded higher up in late spring. Old trees may be grafted to change to a more desirable variety. Much grafting of this kind has been done in California, the large pickling varieties being grafted on small oil olives or on the strong-growing Redding, which bears a worthless fruit and was at one time planted largely in the mistaken belief that it was the large-fruited Picholine. The trees may be cut back to the main branches and crown-grafted immediately or allowed to form a growth of new shoots, which are budded the following year. Much care and work are necessary for several years to prevent the growth of suckers from the old stocks.

Cultivation and pruning.

The planting and cultivation of the olive require the same care as in the case of other fruits. Where the rainfall is ample, thorough cultivation may insure sufficient soil-moisture, but in most cases irrigation is necessary. Cutting back and the removal of ill-placed branches is advisable during the first and second years, and the tree should be allowed to make only one trunk. After the second year, the lower branches should be gradually removed until a clean trunk of 2 or 3 feet is formed. Cutting back and thinning out of the branches should be practised at every winter pruning in order to give the tree the required symmetrical arrangement of branches. For trees which tend to become close and compact, thinning out of branches is chiefly needed; for

those which tend to become weak and elongated, more cutting back is necessary.

By the fifth or sixth year, the framework of the tree should be formed and paying crops produced. The methods of pruning bearing trees vary greatly in various countries. In many, a very severe cutting-back is practised every other year and, as a consequence, the olive bears only on alternate years. The origin of this custom seems to have been due to the olive-fly and scale, which can be fairly well controlled by this means. Trees which are not pruned at all also tend to bear only every other year and to have small inferior fruit. As the olive bears only on the two-year-old wood, like the peach, annual pruning is necessary for annual crops.

The most approved method in California is an annual pruning which consists principally of thinning out from one-third to one-half of the small branches. As much as possible of the removals should be of branches which have borne the preceding year, especially those which have made little new growth. Injured or ill-placed branches are removed and the fruiting surface spread as uniformly over the tree as possible. Vigorous trees should be pruned less than those which are weak and removals made in such a way that light and air reach every part of the bearing wood.

Thorough clean cultivation is needed by the olive and is practised as with other orchard-trees in California. The olive will live with less water than most orchard-trees, but for the production of good crops of large fruit an abundant water-supply is necessary. When the moisture is inadequate, the blossoms do not set well and the fruit is small. Most of the paying orchards are irrigated. Frequent and shallow irrigations are unfavorable to the health and bearing of the



2573. 1, Large knots on still vigorous branch of old olive tree. 2, Young tree planted to replace one destroyed by knot. 3, Small knots on much weakened branch.

tree. Heavy winter and spring irrigations followed by thorough summer cultivation are usually sufficient, though a supplementary watering just before blossoming time (March to May) and one when the fruit is almost of full size are useful in many soils and locations.



2574. Tuberculosis of olive.

Diseases and insects.

The only serious disease which attacks the olive in California is the "olive-knot." This disease is characterized by numerous knots or tumors on the leaves, twigs, branches and trunk, varying in size from $\frac{1}{8}$ inch to 1 or occasionally 2 inches (Figs. 2573, 2574). When badly attacked, the tree is much weakened and, in extreme cases, killed or rendered unprofitable. The disease is infectious and caused by specific bacteria (*Bacterium savastanoi*). Though found in several widely scattered districts, few orchards have been seriously injured and it seems probable that its spread can be controlled by quarantine. It is most harmful to young trees and in rich moist soils of the warmer districts. Eradication by means similar to those used for pear blight seems possible.

A fungous disease of the leaves (*Cycloconium oleaginum*) occurs, but is not important. Rarely, susceptible varieties are slightly weakened by an

unusually heavy attack. Fungous decays of roots and stem have been noted, but do little damage as a rule. Old olive trees in Europe often bear satisfactory crops even after a great part of the interior of the trunk has decayed (Fig. 2575).

The black scale (*Saissetia oleæ*) is very injurious to the olive in the moister regions of the coast ranges, in some parts being so prevalent as to prevent the profitable growing of the tree. In the dry summer air of the interior the scale is absent or not injurious. The noxious olive-fly and olive-moth of Europe do not exist in California.

Harvesting.

The stage of maturity at which the olives are harvested depends upon the use that is to be made of them. For green pickles, they should be gathered as soon as or just before they have reached full size and before they show the slightest change of color. Only at this stage is it possible to preserve the clear yellowish green which the consumer demands and which insures the best price. In ripe pickles, the consumer demands a deep uniform shade as nearly black as possible. Different varieties of olives vary considerably in the amount of coloring matter they contain, but in all varieties it develops its full intensity only at full maturity. As the olives on a tree do not all ripen together, it is customary to wait until nearly all have developed a good black color. If gathered too soon, many will bleach to yellow or red in the pickling process; if left too long many will become too soft. Both these difficulties can be over-

come to a large extent by modifications in the methods of pickling.

When used for oil-making, the quality and quantity of the oil will vary according to the degrees of ripeness of the fruit, when gathered. The maximum quantity is obtained by harvesting the olives when they are completely mature and soft. There is an increase in the percentage of oil afterward, due to a partial drying of the fruit, but no increase in the total quantity of oil. The finest and most highly prized oil is made from olives gathered just before they begin to soften.

In gathering olives for any purpose, they must be picked from the tree by hand and all bruising of the fruit avoided. Cloth bags or lined buckets hung over the shoulders of the pickers are used. Knocking the olives off the trees with rods and gathering from the ground is never practised for pickling olives; nor is it advisable for oil olives, as the mechanical injuries to the fruit promote rotting and molding which much depreciate the quality of the oil. Beating the trees also destroys much of the best fruit wood and tends to promote the spread of the olive-knot disease. Where oil olives can be marketed immediately, they may be gathered by means of special rakes with wooden teeth.

Pickling olives.

When pickles are made, the olives should be cleaned and sized as soon as possible after gathering. The sizing is done by mechanical graders which sort the olives into three or more sizes. The larger sizes are each pickled separately and the smallest used for oil. The grader should be such that the fruit is bruised as little as possible. The cleaning is accomplished by a blower which removes leaves and similar light materials and by running the olives into water which removes the dust.

The pickling process consists in removing the bitterness by means of soda or potash lye and water, then hardening and preserving the olives with a solution of common salt.

The nature of the lye treatment will depend on the variety, size and degree of ripeness of the fruit. For this reason, each variety and grade should be treated separately. The effect of the lye is partially to destroy the bitterness and to make the skin more pervious to the pickling solutions. Some varieties of olives are extremely bitter or thick-skinned and require two or three times as much lye as other varieties. If too little lye is used, the extraction of the bitterness will be very slow and often incomplete; if too much is used, the olives will become soft, the flavor will be injured and the nutritive value impaired by saponification of some of the oil.



2575. Ancient olive tree in orchard in south of France.

Average olives are placed in a solution composed of two ounces of potash lye to one gallon of water. They are left in this solution from four to not more than twelve hours. When the lye has penetrated nearly to the pit as shown by a darkening of the flesh, the olives should be removed to a bath of pure water. With very bitter olives, a second treatment with lye is often necessary. Stronger lye is likely to soften the fruit too much. With very ripe or soft olives, it is necessary to use salt from the beginning in the lye solution. Equal quantities of salt and lye may be used and more time is needed for neutralization owing to the hardening effect of the salt. Some picklers prefer to use a 1 per cent lye for all olives and to repeat the treatment two or three times. The next step is to remove the excess of lye from the olives. If the olives are firm, this is most economically and rapidly accomplished by soaking in pure water which is changed twice a day. If the olives are soft, the water should contain 2 per cent of salt. As soon as no taste of lye remains in the olives, they are placed in a brine composed of four ounces of salt to one gallon of water. This brine is replaced in about two, seven and twenty-one days with brines of six, ten and fourteen ounces to the gallon. This gradual increase of the strength is necessary to prevent shrinkage and shriveling of the olives.

Great care should be taken not to allow the olives to come in contact with anything that will injure their flavor. The vats or other receptacles used for pickling should be perfectly clean, odorless, and tasteless. Concrete is the best material, but wooden receptacles thoroughly treated with boiling water and soda until they are sterilized and all taste of the wood removed, may be used. The vats should be provided with a removable wooden grating, fastened 1 or 2 inches from the bottom, and a close-fitting, floating wooden cover to keep all olives submerged. Each vat should be provided at the bottom with a wooden spigot for drawing off the solutions. The thickness of the layer of olives should not be more than 2 feet, or less with soft varieties.

In pickling green olives, when a light color is desirable, the fruit should be exposed as little as possible to the air, especially during the extraction of the bitterness. In pickling ripe olives, on the contrary, when a uniform dark color is desired, the action of the air is beneficial. A great improvement in this respect can be obtained by leaving the olives exposed to the air for twenty-four hours when making the various changes of lye and salt solutions.

However carefully the processes of pickling are carried out, the olives will keep only for a limited time. They usually remain in good condition for about six months when kept in a strong brine, and the best may last in fair condition for a few months longer. Few olives are good when kept in the ordinary way for twelve months, but by heating them in sealed cans or bottles, they can be kept indefinitely with as great facility as any other food-product. The heating does not injure the flavor and the texture, but, on the contrary, improves them. Olives preserved by heating do not require such strong brine, and it is only necessary to add as much salt as the palate requires.

Olive oil.

The best oil is made by working the olives as soon as they are gathered, but it is usual to dry them partially first to facilitate crushing and pressing. The drying is accomplished by spreading the fruit in layers not over 3 inches deep on wooden trays which are spread out in a well-aerated shed or loft. The olives must be turned daily and prevented from molding. In cool, moist weather this is very difficult, and artificial driers constructed on the same principles as those for fruit and hops are sometimes used. The heat of these driers should be between 120° and 130° F. Higher temperatures produce rancidity of the oil. Artificial drying

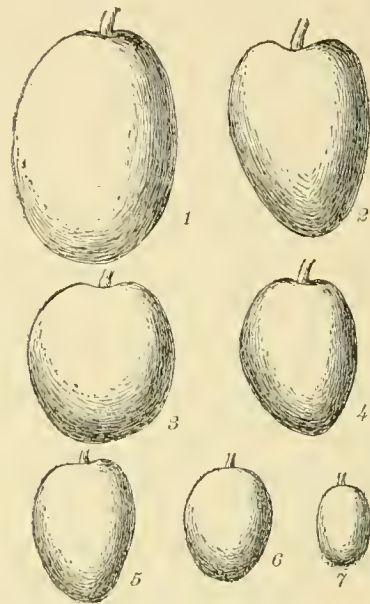
requires about forty-eight hours; natural drying one to two weeks. The dried olives may be stored in a cool, dark, dry place for some time before crushing, but the sooner they are used the better the oil, especially when dried by artificial heat.

The olives are first passed through a crusher consisting usually of corrugated rollers which disintegrate the flesh without breaking the pits. The crushed mass is then put under a press of moderate power. To facilitate the escape of the oil and water, the crushed olives are placed in layers of 3 to 4 inches, inclosed in strong cloth and separated by gratings. After this pressing, the pulp is thoroughly ground, usually with the pits, in an "edge-runner" mill. The ground pulp

is then pressed a second time. The second pressing requires a very powerful press and very strong cloth to contain the pulp. The first pressing may be omitted when the olives are dried.

The liquid which comes from the press contains oil, water and various impurities both solid and dissolved in the water. If allowed to stand, the oil, owing to its light specific gravity, will come to the top and may be skimmed off and freed from floating solid matters by screening.

The separation, however, is very



2576. Varieties of olive. 1, Ascolano; 2, Sevillano; 3, Manzanillo; 4, Mission; 5, Nevadillo; 6, Frantoio; 7, Redding. (X about $\frac{5}{8}$).

slow and imperfect and is facilitated by the process known as "washing." There are various devices for this purpose but they all consist in mixing the press liquids with a stream of pure water with continued gentle agitation. Some of the devices are continuous and the oil rising to the top flows off into the oil vats and the water and impurities escape at the bottom.

The oil thus obtained is more or less cloudy owing to the presence of minute particles of solid matter and must be made perfectly bright before it is merchantable. Perfect clarification of the oil may be accomplished by several successive settlings and decantations. The settling vats may be of tin or concrete. Drawing off after a settling of twenty-four to forty-eight hours removes most of the solid matter. The remainder is removed by two or three drawings-off, each after a settling of about a month. Filtration is usually used to hasten clarification. The most commonly used filtering materials are cotton, pure sand and filter paper. Filtering must be practised with moderation as it tends to diminish the flavor.

Only 50 per cent to 65 per cent of the oil is recovered by the methods now in use in California. The pulp with the retained oil is wasted or used as pig feed. A somewhat large percentage of the oil can be recovered by means of a centrifugal machine and the troublesome pressing and press cloths done away with. This method, however, has never been adapted to an indus-

trial scale. Pressing is also done away with in the "Acapulco" method by which the oil is extracted by a partial vacuum. This method is said to be used successfully in several mills in Spain and Italy.

Varieties.

A very large number of olive varieties have been introduced into California, including the principal varieties of Spain, France and northern Italy. Many of these, especially the Italian varieties, are too small to make acceptable pickles and have been in great part abandoned or grafted over with larger varieties. Most of the recent plantings have consisted of Mission, Ascolano, Manzanillo and Sevillano, though about ten or twelve varieties are still found in commercial quantities. Short descriptions of the chief of these are given.

Mission (Fig. 2576).—The fruit of the common or broad-leaved Mission is typically olive-shaped, slightly oblique and pointed. Its deep color when ripe makes it suitable for ripe pickles. It ripens rather late and does not fruit nor mature well in the cooler sections. It varies in size from small to large according to soil, climate and cultural conditions. The ripe fruit is very bitter but it is firm and easy to pickle. It is one of the best oil olives among the large varieties, both as regards quantity and quality. More than half of the olives of California are of this variety.

Ascolano (Fig. 2576).—This variety, the largest of all the olives grown in California, comes from Italy, where it is grown in the province of Umbria. It is regularly ellipsoidal in shape and has a very small pit. It is sometimes called the "white olive of Ascoli" because it has very little color even when perfectly ripe. This is considered a defect for ripe pickles but by proper aëration during pickling, it can be made sufficiently dark and the color has the advantage of being very uniform. It maintains its size under most conditions and bears good crops in all the sections where it has been tried. It contains very little bitterness and requires very moderate lye treatment. Its flesh is somewhat tender and this and its large size make special care and skill necessary in preparing the ripe pickles. Many picklers have failed in this respect, but by the proper use of salt from the beginning and careful use of lye, success is not difficult and the pickles when well made command the highest price. Plantings of this variety have been heavy for several years and limited only by the scarcity of nursery trees.

Manzanillo, Number 1 (Fig. 2576).—This olive is of Spanish origin and, as its name indicates, it is apple-shaped. It is deeply colored and bitter when ripe and requires treatment with strong lye, but as it softens easily in pickling great care is needed. It ripens several weeks earlier than the Mission. It is on the average a little larger than the Mission though the largest samples of both varieties do not differ much. Its oil is somewhat inferior to that of Mission both in quantity and quality. *Manzanillo, Number 2* is the variety usually pickled in Spain. It is of excellent quality but too small for the Californian market.

Sevillano (Fig. 2576).—This is the variety from which the largest "Queen" olives of Spain are made. The largest specimens excel the Ascolano in size but it is less uniform. It is of typical olive-shape. It has a large pit and is deeply colored like the Mission. It is particularly suited for making both green and ripe pickles, but its large size makes special care necessary in the process. It is a good bearer in good, rich soil in warm localities but its range of adaptation seems more limited than that of the Ascolano.

Macrocarpa and *Polymorpha*, which seem to be synonyms, are very large and suitable for ripe pickles but are liable to a disease causing a spotting or softening of the flesh which much decreases their value.

Among other large-fruited varieties which have been tried and which have given good results in some sec-

tions are Obliza, Salonica, Regalis, Empeltre, and Col-umbella. These are not being largely planted now, as they are excelled in most respects by the four preferred varieties.

Among smaller varieties which under favorable conditions produce fruit large enough for pickling are the Nevadillo blanco, Oblonga, Pendulina and Uvaria. The Nevadillo (Fig. 2576) especially was planted largely at one time and under suitable conditions is one of the best oil olives. It is, however, sensitive to cold, subject to dry-rot of the fruit and in many sections an unreliable bearer. The Picholine, a variety used in France for "olives farcies" gives excellent fruit in California but has been little planted. The so-called Redding Picholine (Fig. 2576), which was largely planted some years ago under the impression that it was the true French Picholine, is a seedling whose fruit is very small and useless. Frantoio (Fig. 2576) is a type of Italian oil olive which does well in California, but is not profitable, as the fruit is too small for pickling.

Literature.

See publications of the Agricultural Experiment Station, Berkeley, California, especially Report for 1896, Bulletin Nos. 120, 123, 129, 137, and 158; also Reports of the Horticultural Commission, Sacramento, California, especially the Proceedings of the Olive-Growers' Conventions. Also Bleasdale, "The Olive Tree and Its Products," 1881; Calkins, "Gleanings in Olive-Culture," 1892; Cooper, "A Treatise on Olive-Culture," 1882; Flamant, "A Practical Treatise on Olive-Culture, Oil-making and Olive-pickling," 1887; Lelong, "The Olive in California," 1888; Marvin, "The Olive," 1888.

FREDERIC T. BIOLETTI.

OLIVE-BARK TREE: *Terminalia Catappa*.

OLIVERÁNTHUS (*Oliver's flower*; named in compliment to G. W. Oliver, U. S. Dept. Agric.). *Crassulacæ*. A genus of 1 species, Mexican, separated from *Cotyledon* (or *Echeveria*), the fls. not strongly 5-angled, very large and solitary, at the ends of slender branches. *O. elegans*, Rose (*Cotyledon elegans*, N. E. Br. *Oliverella elegans*, Rose), is a caulescent and much-branched perennial, 12–20 in. high, with flat fleshy oblanceolate to spatulate lvs. closely placed near the ends of the branches; corolla about 1 in. long, bright red with yellow tips, elongated and the lobes nearly free to the base; carpels 5, free. B.M. 7993. G.C. III. 44:275.—An attractive summer-blooming plant, with large fls. of good substance borne on rather slender branches. It does very well out-of-doors at Washington, in sandy soil.

L. H. B.

OLNĒYA (Stephen T. Olney, American botanist and specialist in *Carex*). *Leguminosæ*. One species, *O. Tesota*, Gray, a small tree (15–20 ft. and more) in S. Calif., Ariz., and Mex., known locally as ironwood: often spiny; lvs. equally or unequally pinnate, the lfts. thick and entire, the stipules none; fls. white or purplish, in short axillary racemes; petals free and equal; stamens 10, diadelphous; pod 1–2-seeded, thick, with coriaceous valves, linear-oblong, 1–2 in. long, hairy. Probably not regularly in cult.

OMALÁNTHUS: *Homalanthus*.

OMPHÁLEA (Greek for *naval* or *center*, from the form of the disk or anthers). *Euphorbiacæ*. Mostly climbing or twining shrubs of the tropics. Juice milky; lvs. alternate, entire, pinnately veined; fls. in terminal panicles, small, apetalous, monœcious; staminate calyx with 4–5 broad, free, imbricate sepals; stamens 2–3, filaments connate; ovary 3-celled, 1 ovule in each cell; fr. large, fleshy outside.—Twelve species in Trop. Amer. and 3 in the Old World tropics. Related to *Sapium* and *Stillingia*. Cult. in rich light soil; prop. by cuttings

rooted with heat. *O. triandra*, Linn., Cor-NUT, Por-NUT, Pig-NUT, with oblong obtuse lvs. and yellow fr. $\frac{1}{2}$ in. thick, has been cult. in Eu. The blackening juice of the fr. has been used in ink and the nuts eaten after removal of the poisonous embryo. W. Indies. L.B.C. 6:519. *O. megacarpa*, Hemsl., with lanceolate, acute lvs., is native and cult. in the W. Indies, the large seeds, HUNTER'S-NUT, being eaten as a nutrient and stimulant. H.I. 2537. *O. diandra*, Linn., with broad ovate or oblong lvs., or a related species, has been intro. from the mountains of Colombia, where the oily seed is eaten and fed to hogs. J. B. S. NORRIS.

OMPHALÔDES (Greek, *navel-shaped*; referring to the seeds). *Boraginææ*. NAVELWORT. Flower-garden and border plants, something like forget-me-not, not often seen in American gardens.

Annual or perennial herbs of low growth, glabrous or sparsely and minutely villous; root-lvs. long-stalked, lanceolate, ovate or cordate; st-lvs. few, alternate; racemes lax, with or without a leafy bract at the base; calyx 5-parted; corolla-tube very short; lobes 5, imbricated, broad, obtuse; stamens 5, affixed to the tube, included; ovary 4-lobed. From *Myosotis* it differs in having depressed nutlets and nearly horizontal seeds, while in the forget-me-not genus the nutlets are ovoid, and the seeds erect. Since the cult. material is doubtful, the descriptions given below are adapted mostly from DeCandolle's *Prodromus*, vol. 10 (1846), with which the pictures cited agree rather poorly. The genus here characterized has the limits understood by Bentham & Hooker, and by Gray.—About two dozen species, native to the Medit. region, Cent. Asia, and Japan; also in Mex. and sparingly in W. U. S. (the latter by some referred to *Eritrichium*). For *O. longiflora*, see *Lindlôphia*. The group to which *Omphalodes* belongs is variously understood by botanists.

Of this genus a few low-growing hardy herbs are cultivated, with flowers much like those of forget-me-not, but larger and usually with a white five-pointed star dividing the corolla-lobes. The flowers are often more or less pinkish, particularly toward the center. They like moist situations, but in deep shade grow too luxuriantly; also the flowers are fewer and of a weaker blue. Partial shade or full sunlight is preferable. The commonest kind is the "creeping forget-me-not," *O. verna*, which is a spring-blooming perennial of easy culture, producing runners freely and easily propagated by division. It can be grown by the yard in a rockery and can be easily naturalized in wild moist half-shaded spots. It is also good for fringing walks. It is said to like best a cool, moist loam, with a few bits of sandstone among which the roots may ramble and from which they may derive coolness and moisture. Perhaps the choicest kind is *O. Lucilia*, also a spring-blooming perennial, but of tufted habit and impatient of division. It is a native of Asia Minor at a height of 8,000 feet, and grows in fissures of vertical cliffs. It is said to like a loose limestone soil, deep and well drained. When once established it self-sows. *O. linifolia* is a summer-blooming annual of easy culture. *O. verna* has a white-flowered kind, which is pretty but to most persons lacks the interest of a blue-flowered forget-me-not.

A. Plant a summer-blooming annual.

linifolia, Moench. Erect, slightly glaucous, 1 ft. high; radical lvs. wedge-shaped; st-lvs. linear-lanceolate, margin remotely ciliate; corolla twice as long as the calyx; nutlets dentate, inflexed at the margin. Dry, stony hills of Spain and Portugal. June-Sept. According to DeCandolle, the fls. are normally white, and it is var. *cærulescens*, DC., which has bluish fls., sometimes tinged with rose. This interesting species belongs to a group of *Omphalodes* in which the nutlets are affixed laterally and lengthwise to the style which is pyramidal and has a square base.

AA. Plants perennials, mostly spring-blooming.

verna, Moench. CREEPING FORGET-ME-NOT. Stoloniferous perennial; flowering-st. erect; lvs. sparsely puberulous; radical ones long-petioled, ovate or subcordate; st-lvs. short-petioled, sublanceolate; all lvs. acuminate, callous at the apex; fls. borne in pairs in a raceme. April, May. Eu. B.M. 7 (as *Cynoglossum Omphalodes*). Gn. 26, p. 315; 40:150; 72, p. 240.—Fls. light blue, according to DeCandolle. Var. *alba*, Hort., is also offered.

Lucilia, Boiss. Glabrous, tufted perennial; lvs. oblong, obtuse, the radical lvs. narrowed into a long petiole, the st-lvs. sessile, upper ones ovate; pedicels longer than the nearest floral lf., erect, then arcuate-recurved; fls. blue; calyx-lobes ovate-oblong, somewhat obtuse, about one-fourth as long as the pedicels; corolla broadly funnel-shaped, about four times as long as the calyx; nutlets with an entire membranaceous margin. Mt. Syphilus near Manesis, and in Cilicia near Gulf of Scanderoon, at 8,000 ft. B.M. 6047 (some fls. light blue, others pinkish purple, all with a white eye). Gn. 27: 194; 69 p. 283. G.C. III. 40:53. G. 28:413.—Fls. about $\frac{1}{2}$ in. across, twice as large as those of *O. verna*.

cornifolia, Lehm. (*O. cappadocica*, DC.). Perennial herb, 6-8 in. high, sometimes grown as an alpine, with variable but usually cordate-lanceolate lvs. which are silky-hairy and with prominent arching veins; fls. about $\frac{1}{2}$ in. across, clear rich blue with small white eye, in loose erect cymes. Asia Minor. G.C. III. 53:380.

nitida, Hoffm. & Link. Perennial, with erect branching glabrous sts.; lvs. oblong-lanceolate, glabrous and shining above, pubescent beneath, the lower ones long-petioled and the upper ones sessile; fls. sky-blue with white center, in very long bractless racemes, the pedicels and calyx pilose. Portugal.—Said to be a plant of neat habit for half-shady moist places.

O. florariensis, Corr., is a garden hybrid between *O. Lucilia* and *O. nitida* (H. Correvon, Floraire, Geneva, Switzerland).

WILHELM MILLER.

L. H. B.†

ONCIDIÏDA (compounded from *Oncidium* and *Cochlioda*). *Orchidææ*. A genus established to contain the hybrids between *Oncidium* and *Cochlioda*.

O. Charlesworthii (*O. incurvum* × *C. Noetzeliana*) has the infl. of the former, the fls. scarlet and lavender. F.E. 33:499.—*O. cinnabarina*=*O. monachicum* × *C. Noetzeliana*.—*O. Cooksonia*=*O. macranthum* × *C. Noetzeliana*.—*O. Mauricii*=*O. tigrinum* × *C. vulcanica*. G.C. III. 55:326.

GEORGE V. NASH.

ONCIDIUM (Greek, *a tubercle*; alluding to the erest on the labellum). *Orchidææ*. Epiphytal orchids for greenhouse growing.

Pseudobulbs usually present, wanting in a few species, 1-2-lvd., with sheathing lvs. at the base; lvs. plane, terete or triangular; petals like the dorsal sepal but often much larger; lateral sepals either free or partially united; labellum variable, but never with its base parallel to the column (*Odontoglossum*), spreading nearly at right angles to the column; column short, winged.—A broad genus with over 300 species distributed in Mex., Cent. and Trop. Amer., and in the W. Indies. In range of altitude the genus extends from the hot coast regions to elevations of 12,000 ft. in the Andes. The fls. of this genus show a remarkable diversity of form. In *O. varicosum*, *O. tigrinum* and related species, the labellum is greatly developed, forming the most conspicuous part of the fl., while in *O. serratum* and *O. macranthum* it is inconspicuous. The sepals and petals vary in size in relation to each other and to the rest of the fl. A remarkable example is *O. Papilio*, in which the petals and dorsal sepal have been transformed into linear-erect segms., recalling, on a large scale, the antennæ of some insect. The general habit of the plants is no less variable than the fls. They

range in size from small erect forms, scarcely 6 in. in height (*O. punilum*), to those resembling *O. altissimum*, with immense climbing panicles 9-12 ft. high and covered with numerous medium-sized fls. The prevailing color of the fls. is yellow, spotted and barred with brown. White or rose-colored fls. occur in a few rare examples (*O. incurvum*, *O. ornithorhynchum*).

As a class, oncidiums are short-lived under cultivation. Few growers succeed in maintaining them in good condition for any great length of time. The stock is constantly renewed from the tropics.

Cultivation of oncidiums.

The genus *Oncidium* embraces a great number of species which are found growing under such peculiar and varied conditions in their native homes that imitation of the same is usually impracticable and often quite impossible. A fair degree of success, however, may be obtained by careful observation and distribution of the exceptionally difficult species among the several orchid departments.

The Sarcopetra section, which embraces such species as *O. Cavendishianum*, *O. Lincanum*, *O. luridum*, *O. pulvinatum* and others of similar structure, and the *O. Papilio* section, with *O. ampliatum*, may be successfully grown in a bright warm portion of the cattleya department in small baskets suspended from the roof, using for a compost a mixture of clean chopped peat and sphagnum moss, freely interspersed with lumps of broken charcoal. *O. cucullatum*, *O. incurvum*, *O. macranthum*, *O. ornithorhynchum*, *O. Phalaenopsis*, *O. varicosum*, with a few others of like nature, do well under treatment similar to that given for odontoglossums, which see.

When a good collection of species is cultivated, a large number, including many of the above, can be readily grown in one house if it be especially adapted to them. Such a house should be a span-roof structure of east and west exposure, at an angle of about 40°, which will admit the longest possible light. The early morning and late afternoon sun striking the glass at right angles produces and prolongs the natural sun heat for a greater part of the day, while at midday, when the outside temperature is highest, the sun's rays strike the glass obliquely, giving less heat, with little danger of the plants becoming sunburned from lenses in the glass. Oncidiums require more sun and air than most orchids.

The benches may be of either wood or stone, and should be covered an inch or two in depth with sand, ashes or gravel. The benches and paths should be wet down once or twice daily to insure a moist atmosphere. Ventilators should be arranged on both sides of the roof: air may then be freely admitted without causing direct drafts on the plants by using the ventilators on the sheltered side. In winter the temperature should range from 50° to 55° F. at night and 60° to 65° by day, or a few degrees more with sun heat and ventilation. In summer it must be kept as low as outside conditions will permit. From March until October, shading must be applied to the glass sufficiently heavy to keep down the temperature without excluding indirect solar influence. A good shading is made of turpentine and white lead; it stands well and is easily removed. It can be applied rapidly with a whitewash brush on a long pole, and removed with a hard brush in the fall.

Oncidiums may be grown in either pots or baskets, but as many species are of rambling habit, the latter are preferable. The tiny species, such as *O. Limminghii*, do best on blocks with little compost beneath them. Clean chopped peat fiber and live sphagnum moss, equal parts, make the best general growing material, and this should be liberally interspersed with broken pieces of charcoal. The plants in all cases must be securely fastened, and the compost must be pressed in moderately firm, but should be used sparingly. Overhead

syringing should be given frequently, about once or twice a day in bright weather, but care must be taken not to keep the compost too wet, for the roots are liable to decay: it is advisable to let them dry out occasionally.

Stock is increased by division or notching the rhizome between the pseudobulbs just before the growing season, allowing about three or four pseudobulbs to each piece and separating the parts after the first growth is matured.

For other cultural notes on the genus, see the various manuals on orchid-growing.

ROBERT M. GREY.

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SYNOPSIS OF SECTIONS.

A. Lvs. plane, not terete.	
B. Labellum smaller than the sepals and petals.	Species 1-5
BB. Labellum at least as large as the other segms., often greatly exceeding them.	
C. Lateral sepals more or less united at base.	Species 6-18
CC. Lateral sepals free.	
D. All the segms. having a distinct blade, none of them linear-subterete.	
E. Pseudobulbs present.	Species 19-37
EE. Pseudobulbs wanting or obsolete.	Species 38-44
DD. Only lateral sepals with distinct blade; dorsal sepal and petals elongate, linear, erect, with an obsolete blade.	Species 45-46
AA. Lvs. terete or subterete.	Species 47-48
AAA. Lvs. subtriangular in section.	Species 49

DESCRIPTION OF SPECIES.

A. Lateral sepals united at base.	1. micropogon
AA. Lateral sepals free.	
B. Sepals and petals linear, flaccid.	2. phymatochilum
BB. Sepals and petals broad, serrate.	3. serratum
BBB. Sepals and petals broad, entire or subentire.	
C. Fls. brown.	4. superbiens
CC. Fls. yellow.	5. macranthum

1. *micropogon*, Reichb. f. Pseudobulbs almost in 2 rows on the rhizome, broadly ovoid; lvs. 4-6 in. long, linear-oblong, rounded at the top, leathery; raceme 8-10 in. long, on a long stalk, flexuous, pendulous; fls. 1½ in. across; sepals linear-oblong, undulate, yellow, barred with brown; petals clawed, orbicular, yellow, with a deep red-brown claw; labellum yellow, smaller than the petals, having 3 almost equal, rounded, clawed lobes. Aug. Trop. Amer. B.M. 6971. Gt. 4:308. Var. *superbum*, Hort., is advertised.

2. *phymatochilum*, Lindl. Pseudobulbs broadly fusiform, 4-5 in. long, purplish brown, with several large

scales at the base: lvs. membranous, oblanceolate, 12-14 in. long; scape rather slender, over 1 ft. long, with a pendent panicle more than a foot long: sepals and petals linear-subulate, flaccid and somewhat twisted, greenish yellow, with deep orange blotches; labellum shorter than the sepals, white, with a yellow and orange crest; the middle lobe triangular-ovate, acuminate. Brazil. B.M. 5214. F.S. 23:2465. G.C. 1848:139.

3. *serratum*, Lindl. Fig. 2577. Pseudobulbs 4-6 in. long, partly inclosed by sheathing lvs., 1-2 lvs.; lvs. about 1 ft. long and 2 in. broad: infl. a long, twining, loosely-branched panicle, 6-10 ft. long; fls. numerous, 3 in. across; upper sepals broad, reniform, the lateral ones very much longer, obovate, all chocolate-brown, with yellow tips and margins, strongly undulate, serrate; petals shorter, oblong, wavy and curled so that they almost meet over the column, yellow with brown



2577. *Oncidium serratum*. ($\times \frac{1}{2}$)

spots, margins serrate; labellum small, hastate, fleshy, with a crest of 5 ridges. Winter. Peru. B.M. 5632. F.S. 6, p. 167.

4. *superbiens*, Reichb. f. Pseudobulbs 3-4 in. long, ovate to ovate-lanceolate, much flattened: lvs. linear, 14 in. long and $1\frac{1}{4}$ - $1\frac{1}{2}$ in. broad, some sheathing the pseudobulb; panicle 2-3 ft. long, loosely branched and flexuous, bearing 20-30 fls. each $2\frac{1}{2}$ in. diam.; sepals long-clawed, undulate, chocolate-brown with yellow tips; the upper one trowel-shaped, with a cordate base, the lower pair more ovate; petals rather smaller, with shorter, broader claws, much recurved and wavy, yellow with brown bars; labellum less than half as large as the sepals, revolute, trowel-shaped, with auriculate side lobes, brown with a yellow crest. Spring. Venezuela, Colombia. B.M. 5980.

5. *macranthum*, Lindl. (*O. hastiferum*, Hort.). Pseudobulbs ovoid or flask-shaped, 3 in. long: lvs. narrowly lanceolate, acuminate, 1 ft. long; panicle clinb-

ing, loosely branched and many-flid.; fls. 3-4 in. across; sepals rounded-oblong, with green claws, the upper one yellowish brown, the lower pair orange-yellow; petals similar, golden yellow, streaked with blood-red at the base; labellum small, hastate, purple-brown, with a prominent white crest. Spring and summer. Cent. Amer. B.M. 5743. Gn. 24:486. F. 1871, p. 187. J.H. III. 31:337.—A magnificent orchid, of which there are several varieties, some of secondary merit.

- A. Petals clawed, with a broad, obovate or rounded blade, not much smaller than the labellum.
- B. Fls. yellow; column-wings short, quadrate..... 6. *Marshallianum*
- BB. Fls. red-brown; column-wings narrow, angular..... 7. *Forbesii*
- BBB. Fls. dull brown, with yellow markings.
- c. Column-wings small, truncate.... 8. *curtum*
- cc. Column-wings large, sharply serrate..... 9. *crispum*
- AA. Petals and dorsal sepals obovate, cucullate, not clawed..... 10. *cornigerum*
- AAA. Petals and dorsal sepals subsimilar, very small; labellum larger than the rest of the fl.
- B. Labellum white, spotted with rose-purple..... 11. *cucullatum*
- BB. Labellum yellow.
- c. Blade bifid..... 12. *Martianum*
- cc. Blade quadrifid..... 13. *flexuosum*
- AAAA. Petals and sepals lanceolate, ovate, at least one-half as long as the labellum and of a different form.
- B. Fls. white, spotted with purple..... 15. *Phalænopsis*
- BB. Fls. yellow or greenish, spotted and barred with brown.
- c. Crest serrate..... 16. *longipes*
- cc. Crest a smooth, heart-shaped callosus..... 17. *dasystyle*
- BBB. Fls. entirely yellow..... 18. *concolor*

6. *Marshallianum*, Reichb. f. Pseudobulbs ovoid, 2-4 in. long; lvs. narrowly oblong, 6-8 in. long; fls. numerous, $2\frac{1}{2}$ in. across, borne on a stout panicle 1-2 ft. high; the upper sepals oblong-apiculate, the lateral ones united, yellow, with purplish bands; petals much larger, fiddle-shaped, wavy and 2-lobed, golden yellow, with few blotches of chocolate-brown; labellum with a very large spreading 2-lobed middle lobe and ear-like side lobes, yellow, with orange-red spots on the base. May. Brazil. B.M. 5725. F.M. 1877:285.—A very effective and showy plant related to *O. crispum*. Var. *sulphureum*, Hort., has yellow fls. without the usual markings.

7. *Forbesii*, Hook. Pseudobulbs rather small, oblong, compressed and sulcate: lvs. lanceolate, dark green, 9 in. long; panicle about 1 ft. high, bearing numerous handsome fls. 2 in. across; fls. rich reddish brown, margined with yellow; sepals small, obovate; petals twice as large, obovate-rotund; side lobes of the labellum small; middle lobe spreading, fan-shaped. Autumn. Brazil. B.M. 3705. G.C. 11. 11:525.—A rare but very ornamental orchid. Var. *atratum*, Hort., has large fls., purple-brown. Var. *Bradshawæ*, Hort., an alpine form with yellow markings.

8. *curtum*, Lindl. Lvs. and pseudobulbs like those of *O. crispum*: infl. an erect, much-branched pyramidal panicle; fls. $1\frac{1}{2}$ in. across; lateral sepals united, rather small; dorsal sepals and petals obovate-obtuse, yellow, with reddish brown bars and blotches; labellum with small lateral lobes and a roundish, notched middle lobe, yellow bordered with brown; crest lobed and warty, yellow, with red spots. Brazil. B.R. 33:68. Gn. 10, p. 131; 31, p. 198; 34, p. 87.—Blossoms in spring, the fls. remaining fresh for several weeks.

9. *crispum*, Lodd. Pseudobulbs oblong, sulcate, rough and usually dark brown: lvs. leathery, lanceolate,

about 9 in. long; fl.-st. 1-1½ ft. high, arched, bearing 20-50 large fls. 1½-3 in. across; fls. shining brown, with few yellow and red marks at the bases of the segms.; sepals obovate, obtuse, recurved and undulate, the lateral ones united; petals twice as large, broadly obovate, obtuse, much waved and crisped; middle lobe of the labellum large, rotund-cordate, waved and crisped; lateral lobes small, horn-like. Fls. at various seasons. Brazil. B.M. 3199. B.R. 1920. L.B.C. 19:1854. F.S. 21:2147, 2148. F.C. 2:64. B. 1:26. O. 1912, p. 18; 1913, p. 74. Var. *grandiflorum*, Hort. Fls. very large, the segms. edged with yellow.

10. *cornigerum*, Lindl. Pseudobulbs oblong, sulcate, 3 in. long, 1-lvd.; lvs. dark green, broadly ovate to oblong, fleshy, ribbed, 4 in. long; panicle about 18 in. long, drooping, branched and crowded with fls. above; fls. small but numerous, yellow, spotted with red; dorsal sepals and petals obovate, concave, undulate, the lateral sepals smaller and united; labellum with long-linear lateral lobes and 2 horn-like processes at the base; middle lobe obovate, subrepand. April, May. Brazil. B.M. 3186. B.R. 1542.—A compact free-flowering plant which is very attractive when grown in baskets so that the long racemes can hang over the sides.

11. *cucullatum*, Lindl. Pseudobulbs oval, 1½ in. long, smooth, becoming ribbed; lvs. oblong-lanceolate, 6 in. long; raceme almost simple, 8-12 in. long, bearing 6-12 fls. 1¼ in. across; dorsal sepals and petals small, oval, greenish, shaded with rose-purple; lateral sepals almost entirely united; labellum cordate-panduriform, with the middle lobe much dilated and 2-lobed, white to rose and spotted with dark purple. Spring. Colombia. F.S. 8:835; 23:2457. J.F. 3:317. J.H. III. 49:365. I.H. 25:305. Gn. 22:166 (var. *giganteum*).—A species with many varieties, which differ in shape and coloring of the fls. It is one of the coolest of the Andean orchids. Var. *nubigenum*, Lindl. Raceme suberect; sepals and petals white or light purple, with green tips; labellum white, with a purple blotch around the crest. B.M. 5705.

12. *Martiianum*, Lindl. (*O. bicolor*, Lindl.). Pseudobulbs ovate, compressed and ribbed; lvs. oblong, striate; fls. yellow, spotted; lateral sepals united, ovate, acute; petals obovate, concave; middle lobe of the labellum larger than the rest of the fl., 2-parted by the deep sinus in front, clear yellow. Autumn. Brazil. B.R. 29:66.—A beautiful yellow species, with a panicle 2 ft. high.

13. *flexuosum*, Sims. Pseudobulbs ovate, flattened, 2 in. long; lvs. linear-oblong, 6 in. long; fls. scarcely 1 in. across; sepals and petals small, recurved, yellow, with chestnut bars; labellum yellow, with few reddish spots; side lobes small; middle lobe reniform, notched. Brazil. B.M. 2203. L.B.C. 5:424. Gn.W. 7:53.—The plant blooms freely at various seasons. The fls. open in succession on a loose spreading panicle about 2 ft. high. Var. *unicolor*, Hort., has clear unspotted fls.

14. *varicosum*, Lindl. Pseudobulbs ovate, angled, 2-4 in. long; lvs. rigid, linear-lanceolate, 9 in. long; fl.-spikes strong, arching, 3 ft. long, with numerous fls. 1 in. across; sepals and petals small, green, with brownish blotches; labellum very large in proportion to the fl., bright yellow, with a curiously toothed crest; lateral lobes rotund; middle lobe reniform, obscurely 4-lobed. Winter and spring. Brazil.—One of the most attractive. J.F. 2:206, 207. J.H. III. 54:497; 69:355. Var. *Rogersii*, Reicheb. f. (*O. Rodgersii*, Hort.). Fig. 2578. The best variety. Specimens have borne 150 fls., with the lip over 2 in. across, rich yellow, with a few red bars at base. G.C. 1870:277. F.S. 18, p. 150. F. 1870:25. Gn. 55:408. G.M. 39:366. A.F. 17:10. Gng. 10:38. J.H. III. 49:433. O. 1912, p. 18. Var. *Charlesworthii*, Hort.. Lip 2¾ in. across. G.M. 45:566.

Var. *moortebeekiense*, Hort. A large reddish brown blotch at base of lip. G.M. 45:177.

15. *Phalænopsis*, Lind. & Reicheb. f. A small-growing plant, with pseudobulbs oblong, somewhat ribbed, 1-2 in. high; lvs. narrow at the base, broadening upward, about 6 in. long; fls. 3-6 on a slender raceme, gaily colored, creamy white, with the sepals and petals barred with reddish purple, and the base of the lip profusely spotted with the same color; sepals and petals quite similar, oblong, acute; labellum pandurate, with 2 rounded lobes in front. Blooms at various seasons, and lasts a long time. Ecuador. I.H. 17:3. Gn. 41:492. J.H. III. 28:515.—A beautiful little plant, worthy of extended cult. Much like *O. cucullatum*.

16. *longipes*, Lindl. (*O. jancieirense*, Reicheb. f.). Pseudobulbs narrowly ovate, 2-lvd.; lvs. narrow; scape several-flid., equaling the lvs.; fls. on long pedicels; lateral sepals elongate, pendulous, united at the base;



2578. *Oncidium varicosum* var. *Rogersii*. (×½)

dorsal sepals shorter and wider, recurved; petals oblong, plane; all yellowish green, barred with brown; labellum yellow, spotted with brown at the base; lateral lobes small, obtuse; middle lobe transversely broadened, apiculate, the narrow part serrated. Summer. Brazil. I.H. 2:54. B.M. 5193 (called *O. longipes*, is *O. Cræsus*, Reicheb. f.).—A small species.

17. *dasystyle*, Reicheb. f. Pseudobulbs ovate, flattened, strongly rugose; lvs. 4-5 in. long, linear-lanceolate; scape very slender, 6-7 in. long, bearing 2-5 fls., each 1½ in. across; dorsal sepals and petals subequal, lanceolate, pale yellow, blotched with purple-brown; lateral sepals larger, united half-way; labellum large, sulfur-yellow, with a blackish purple callus; lateral lobes small, triangular; middle lobe round-fan-shaped, membranous and undulate. Jan., Feb. Organ Mts., Brazil. B.M. 6494.

18. *cóncolor*, Hook. (*O. unguiculatum*, Klotzsch). Pseudobulbs small, oval-oblong, slightly furrowed; lvs. lanceolate; fls. 1-2 in. diam., rich yellow, borne on pendulous racemes 1-2 ft. long; lateral lobes united for half their length, smaller than the dorsal sepals and petals, which are obovate; labellum twice as long as

the sepals, broad, flat, bilobed, with 2 reddish ridges running down on the base. April-June. Organ Mts. B.M. 3752. I.H. 30:487. R.H. 1881:30. Gn. 13:58. G. 26:237; 27:133; 35:301. — A plant of close and compact habit, making one of the most attractive yellow coolhouse orchids. Var. *rhodoptera*, Hort. Upper part of column-wings and margin of stigma red.

- A. Labellum with a large reniform middle lobe; lateral lobes small or none.
 B. Petals much broader than the sepals 19. *ampliatum*
 20. *excavatum*
 BB. Petals and sepals nearly of the same size.
 C. Fls. over 2 in. across; labellum large, forming the most conspicuous part of the fl.; panicle stout. 21. *tigrinum*
 22. *splendidum*
 CC. Fls. medium-sized, numerous, in long, climbing panicles.
 D. Sepals and petals linear-lanceolate, acute.
 E. Color of fls. white and purple. 23. *incurvum*
 EE. Color of fls. yellow and brown.
 F. Column-wings very truncate; crest of several interrupted ridges. 24. *Baueri*
 FF. Column-wings rounded, slightly crenulate. 25. *altissimum*
 FFF. Column-wings erose, sphacelate. 26. *sphacelatum*
 FFFF. Column-wings falcate, dentate. 27. *reflexum*
 DD. Sepals lanceolate; petals spatulate. 28. *Batemanianum*
 DDD. Sepals and petals linear to oblong, obtuse.
 E. Color of labellum yellow. 29. *Harrisonianum*
 EE. Color of labellum white. 30. *leucochilum*
 AA. Labellum with the middle lobe variously shaped, rarely reniform, but more so than the lateral lobes, large.
 B. Fls. rose-colored. 31. *ornithorhynchum*
 BB. Fls. yellow, variously marked and spotted.
 C. Crest pulvinate, pubescent. 32. *divaricatum*
 33. *pulvinatum*
 CC. Crest not pulvinate.
 D. Apex of labellum deeply 2-lobed. 34. *Warneri*
 DD. Apex of labellum apiculate, lateral lobes tooth-like. 35. *maculatum*
 DDD. Apex of labellum merely emarginate, lateral lobes large.
 E. Middle lobe broadly reniform, clawed. 36. *Limminghii*
 EE. Middle lobe not clawed, separated from the lateral lobes merely by a sharp constriction. 37. *cheirophorum*

19. *ampliatum*, Lindl. Pseudobulbs subrotund, compressed, bright green with purple spots, becoming blackish purple and wrinkled with age; lvs. plane, oblong-lanceolate, 9 in. long; infl. a large panicle 1-3 ft. long, with numerous fls., which are yellow, spotted with red at the bases of the segments; sepals and petals small, the former entirely free; labellum reniform, spreading, wavy, 1½ in. across, narrow at the base, with 2 small lateral lobes and a prominent lobed crest. March-May. Throughout the coast of Nicaragua. B.R. 1699.—The fls. are produced in magnificent panicles. In var. *majus*, Hort., they are half again as large as in the type. F.S. 20:2140, 2141. G.C. III. 17:173. Gn. 45, p. 491. G.M. 37:475. C.L.A. 6:166. G. 17:202. J.H. III. 54:295.

20. *excavatum*, Lindl. (*O. aurorum*, Reichb. f. & Warscz.). Pseudobulbs oblong, compressed, 3-5 in. long; lvs. 1½ ft. long, leathery, shining green; panicle 3-5 ft. long, with numerous fls. 1½ in. across, yellow, spotted

with brown; sepals obovate, obtuse, free; petals oblong, retuse; labellum sessile, with several broken ridges near the base, pandurate, excavated on the under side; middle lobe rotund, emarginate. Autumn. Peru. B.M. 5293. I.H. 17:34.—Strong plants produce as many as 100 fls. on each panicle.

21. *tigrinum*, Lallave & Lex. (*O. Barkeri*, Lindl. *O. unguiculatum*, Lindl.). Fig. 2579. Pseudobulbs oval, compressed, 2-lvd.; lvs. oblong-lanceolate, thick, 1 ft. long; panicle erect, stout, 3 ft. high; fls. 2½ in.



2579. *Oncidium tigrinum* (*O. Barkeri*), to show habit.

across; sepals and petals similar, lanceolate, undulate, rich reddish brown, with few bars and spots of yellow; labellum yellow, with a very large, orbicular-reniform blade supported on a long claw, lateral lobes oblong. Winter. Mex. I.H. 1:2;

22:221. P.M. 14:97. R.H. 1889, p. 176.—Very much like *O. splendidum*, from which it differs by the longer claw of the labellum having a thick keel, and the oblong lateral lobes of the labellum. Both are among the most showy oncidiums in cult. Var. *grandiflorum*, Hort., is advertised. Var. *Croëkii*, Hort. Sepals and petals marked with light brown bands.

22. *splendidum*, A. Rich. Pseudobulbs small, round, compressed, 1-lvd.; lvs. leathery, oblong-ovate, 6-12 in. long; fl.-stalk erect, 2 ft. long; fls. 3 in. across; sepals and petals similar, lance-oblong, acute, recurved, yellow-green, with broad brown bands; labellum very large, yellow, the broad claw of the middle lobe expanding into a large reniform blade; lateral lobes small, rotund. Spring. Guatemala and Mex. B.M. 5878 (as *O. tigrinum* var. *splendidum*). F.S. 18:1825. Gn. 51:410. R.B. 17:108. G.C. 1871:42; III. 3:108.

23. *incurvum*, Barker. Pseudobulbs ovate, compressed and ribbed, 2 in. long; lvs. 9 in. long, ensiform, acute; panicle 2-3 ft. long, slender, much branched and gracefully arched; fls. 1½ in. across, numerous; sepals and petals linear-lanceolate, undulate, white, banded with purple; labellum white, with a purple blotch; lateral lobes rotund, small; middle lobe subreniform, concave. Bears numerous panicles in autumn. Mex. B.M. 4824. B.R. 31:64. I.H. 2:49; 29:444 (white variety).

24. *Baueri*, Lindl. (*O. altissimum*, Lindl.). Pseudobulbs oblong, compressed; lvs. ensiform, rigid, keeled; panicle with numerous branches and rather dingy fls.; sepals and petals about as long as the labellum, linear-lanceolate, undulate, yellow, with red spots; labellum with 2 spreading lateral lobes and a reniform emarginate middle lobe, yellow, with a reddish band. Trop. Amer. B.R. 1651 (as *O. altissimum*).—A gigantic epiphyte with fl.-sts. 6-9 ft. long and "lvs. as long." It has been confused with *O. altissimum*.

25. *altissimum*, Swartz. Pseudobulbs nearly rotund, much compressed and edged; lvs. 1-2 at the top and several at the base of the pseudobulb, ensiform, keeled, 1½-2 ft. long; infl., an almost simple, drooping raceme, 4-6 ft. long; sepals and petals free, similar, spreading, linear-lanceolate, undulate, pale yellow, with olive-brown blotches; labellum nearly as long as the petals, fiddle-shaped, with the middle lobe reniform, spreading, yellow, with a brown band near the center, prominently crested. Aug. W. Indies. B.M. 2990. B.R. 1851.

26. *sphacelatum*, Lindl. Pseudobulbs elongate-ovate, compressed; lvs. long, ensiform, apex recurved; scape

strict, bearing a many-fl. panicle; sepals and petals linear-lanceolate, undulate, yellow, spotted with brown; labellum about as long as the sepals; lateral lobes auriculate; middle lobe with 2 rotund lobes, yellow, with brown spots at the base. Spring. Honduras and W. Indies. B.R. 28:30. Var. *grandiflorum*, Hort., is a better variety.

27. *reflexum*, Lindl. Pseudobulbs ovate, 1-lvd.: lvs. narrowly lanceolate, acute; panicle with its stalk 3-4 ft. long, pendulous; sepals and petals linear-lanceolate, undulate and reflexed, yellowish, shaded with pale brown; labellum with a large, reniform, emarginate middle lobe and rotund lateral lobes, yellow, with few reddish spots on the base. Mex. B. 3:116.

28. *Batemanni*um, Parin. Pseudobulbs large, 4-5 in. long, with sheathing lvs. at the base; lvs. oblong-ensiform, 2 ft. long; scape erect, 6-8 ft. long; sepals lanceolate, undulate, reddish brown, slightly marked with yellow; petals similarly colored, spatulate and very much undulate; labellum brilliant yellow, with the crest marked with brown; lateral lobes small, rounded; middle lobe large, reniform, emarginate. Brazil. F.C. 3:137.—Related to *O. altissimum*.

29. *Harrisoni*um, Lindl. (*O. Harrisianum*, Hort.). Pseudobulbs subglobose, 1-lvd.: lvs. linear-oblong, acute, fleshy and recurved; panicle about a foot high, erect, with the st. and branches gracefully curved; sepals and petals linear, obtuse, yellow, spotted with purple-brown; labellum yellow, longer than the sepals, with small lateral lobes and a subreniform, emarginate middle lobe. Autumn. Brazil. B.R. 1569. L.B.C. 20:1917. R.B. 18:253. O. 1912, p. 8. G.W. 11, p. 518; 14, p. 519.

30. *leucochilum*, Batem. Pseudobulbs sulcate, ovate, compressed, 2-4 in. long; lvs. sword-shaped, 1 ft. or more in length; scape 3-4 ft. high, with numerous branches on which the fls. are loosely scattered; sepals and petals oblong, obtuse, green, blotched with reddish brown; labellum pure white; lateral lobes small, rounded; middle lobe broadly reniform, emarginate. Autumn. Guatemala. F.S. 5:522. P.M. 7:241. G. 28:387. J.H. III. 43:215.—A noble species, with the habit of *O. Baueri*. Panicles 6-9 ft. long. Var. *splendens* is listed.

31. *ornithorhynchum*, HBK. Fig. 2580. Pseudobulbs oblong, compressed, 2-3 in. long, 2-3-lvd.: lvs. grass-like, 8-12 in. long; stalks 1 ft. long, slender and arched, many-fl.: fls. scarcely 1 in. across, soft rose-purple; sepals linear-oblong, wavy; petals oblong and a little broader; labellum pandurate, with small lateral lobes and a larger dilated, emarginate middle lobe. Fragrant. Autumn and winter. Mex. B.M. 3912. B.R. 26:10. F.C. 3:136. R.H. 1876:230.—This is an easily grown, free-flowering plant of dwarf, compact habit. Its soft rose-purple color is very delicate and unusual in the genus. Var. *albiflorum*, Reichb. f. (var. *album*, Hort.). Fls. whitish, with only the calli yellow. F.M. 1880:398. G.C. III. 16:781. J.H. III. 29:399. G.M. 38:18. There is also a variety called *majus*.

32. *divaricatum*, Lindl. Pseudobulbs compressed, each with a fleshy, oval, apiculate lf.: scape 1½ ft. high, with the branches of the panicle extremely divaricate; sepals and petals oblong-spatulate, greenish yellow, spotted with purple toward the base; labellum yellow, spotted with red; lateral lobes large, half-rotund; middle lobe smaller, emarginate. Autumn. Brazil. B.R. 1050. L.B.C. 13:1212. P.M. 3:4.—A floriferous species easily recognized by its singular oval, fleshy lf. and the divaricate panicle.

33. *pulvinatum*, Lindl. Panicle very much branched, in a loose, spreading manner, weak, 8-9 ft. long; fls. yellow, with the sepals and petals blotched with red; segms. obovate, acute; the 2 parts of the labellum nearly equal; lateral lobes rotund-crenate and crisp;

middle lobe undulate, crest a villous cushion. Summer. Brazil. B.R. 25:42.—One of the largest of the oncidiums. The fls. last a long time. Var. *majus*, Hort., is said to be desirable.

34. *Wärneri*, Lindl. (*Odontoglössum Wärneri*, Lindl.). Pseudobulbs ovate, somewhat angular: lvs. linear-lanceolate; raceme short, few-fl.; sepals oblong; petals a little wider; all white or yellowish, striated with rose-purple; labellum brilliant yellow; lateral lobes subquadrate; middle lobe deeply divided into 2 rounded lobes. Autumn. Mex. B.R. 33:20 (var. *purpuratum*, Lindl.).

35. *maculatum*, Lindl. Pseudobulbs ovate, compressed, 4-angled, 2-lvd.: lvs. broadly linear-oblong; fls. 1¼ in. across, yellow, spotted with deep purple; sepals and petals subequal, rather fleshy, ovate-subacuminate; labellum oblong-apiculate, the lateral lobes forming 2 large teeth near the middle; middle lobe ovate, sulfur-yellow, base marked with few red lines, claw with 4 horn-like plates. Winter. Mex. B.M. 3836 (var. *ecornutum*) and 3880. B.R. 24:44. F.C. 2:57 (all as *Cyrtorchilum maculatum*).

36. *Límminghi*, Morr. Pseudobulbs oval, compressed: lvs. oblong, acute, mottled; raceme 1-2-fl., erect, several times longer than the small lvs.; fls. yellow, spotted and banded with brown; sepals and petals

lanceolate, the lower pair larger; labellum with large, auriculate lateral lobes and a transversely broadened, subreniform, emarginate mid-lobe, spotted with red. June, July. Caracas. F.S. 18: 1827.—A pretty dwarf plant with the habit of a *sophronitis*.

37. *cheiróphorum*, Reichb. f. Pseudobulbs 1 in. long, ellipsoid: lvs. 3-6 in. long, linear-lanceolate; scape bearing a dense panicle longer than the lvs.; fls. about ½ in. across, entirely bright yellow,

with greenish sepals; sepals and petals small, rounded-ovate, spreading or reflexed; labellum much larger, with three large lobes, the middle lobe notched. Colombia. B.M. 6278. G.C. 1871:168, desc. J.H. III. 65:591; 68:575.



2580. *Oncidium ornithorhynchum*. (×¼)

- A. Plants dwarf, scarcely over 8 in. high.
 - B. Labellum with 3 equal lobes 38. *pumilum*
 - BB. Labellum with small lateral and a 4-parted middle lobe 39. *Crista-galli*
- AA. Plants large.
 - B. Wings of the column narrow, fal-cate 40. *bicallosum*
 - BB. Wings of the column fleshy, rotund, reniform, etc. 41. *Cavendish-ianum*
 - C. Labellum pandurate, with trian-gular lateral lobes 42. *Lanceanum*
 - cc. Labellum reniform, with small blunt lateral lobes 43. *carthaginense*
 - cc. Labellum reniform, with small blunt lateral lobes 44. *luridum*

38. *pumilum*, Lindl. A small plant about 6 in. high, without pseudobulbs, and with oblong, leathery lvs.: infl. a small, branched panicle, scarcely longer than the lvs.; sepals and petals obovate, yellow, spotted with brown; labellum yellow, rounded, trifid. Spring. Brazil. B.M. 3581. B.R. 920. L.B.C. 18:1732. J.H. III. 47:459.

39. *Crista-galli*, Reichb. f. (*O. iridifolium*, Lindl., not HBK.). Lvs. radical, cuneiform-ligulate, 2-3 in. long; fl.-sts. several, 1-2-fl., slightly exceeding the lvs.: fls. yellow, with few red spots at the base of the segms. and labellum; sepals lanceolate, acute; petals oblong, crisp, much wider; labellum large; lateral lobes oblong-cuneate; middle lobe divided into 4 lobes, of which the inner 2 are smaller. B.R. 1911.—A very small, neat plant.

40. *bicallösium*, Lindl. Pseudobulbs none; lvs. large, oblong-lanceolate, keeled, thick and leathery; panicle many-fl., variable in size; fls. 2 in. diam.; sepals free, obovate, concave; petals oblong-obtuse, undulate; all

rich yellow or honey-colored, bordered with cinnamon-color; labellum with small, narrow lateral lobes, and a pair of tubercles for a crest; middle lobe large, transversely expanded, emarginate, subcordate. Autumn and winter. Guatemala. B.M. 4148. B.R. 29:12. I.H. 12:458.

41. *Cavendishianum*, Batem. Pseudobulbs none; lvs. fleshy, broadly lanceolate, 1-1½ ft. long; scape 4 ft. high, erect, with a dense panicle about 1 ft. long; sepals and petals oblong-obtuse, greenish yellow, with bright chestnut spots; labellum yellow; lateral



2581. *Oncidium Papilio*. (X½)

lobes rather large, spreading, rounded, narrowed to a claw; mid-lobe broadly reniform and deeply emarginate. Guatemala. G. 27:164. G.W. 3, p. 471.—Grows very slowly.

42. *Lanceanum*, Lindl. Pseudobulbs wanting; lvs. fleshy, oblong, acute, 1 ft. long and about 3 in. broad; scape stiff, erect, branched above and 1 ft. or more in length; fls. 2-3 in. across, numerous; sepals and petals oblong, obtuse, fleshy, concave, yellow, marked and barred with chocolate-brown or crimson; labellum narrow in the middle, with the 2 lateral lobes forming a hastate base, middle lobe broadly expanded, cuneate. The color of the labellum is variable, usually rose in front, becoming violet toward the base. Summer. British Guiana. B.R. 1887. F.S. 18:1842, 1843. P.M. 4:169. F.C. 2:79. G.C. II. 21:609; III. 54:279. G. 31:613. G.W. 10, p. 403. Var. *superbum*, Hort., is described as a superior variety. Var. *Louvrexianum*, Hort. (*O. Louvrexianum*, Hort.). A variety with yellow fls., prettily spotted and marbled; labellum yellow at the base, white in front.

43. *carthaginense*, Swartz (*O. Henchmannii*, Lodd. *O. roseum*, Lodd. *O. undulatum*, Salisb. *O. sanguineum*, Lindl.). Pseudobulbs obsolete; lvs. solitary, oblong, arching; panicle 3 ft. long and loose; fls. small, whitish, marked and blotched with red and bordered with yellow; sepals and petals oblong-ovate, free, wavy; labellum with horizontal, triangular lateral lobes and a

fan-shaped middle lobe, crimson, with a yellow border. Summer. Trop. Amer. B.M. 3806 (as *O. Huntianum*). F.C. 3:97 (as *O. luridum* var. *Henchmannii*).

44. *luridum*, Lindl. Lvs. elliptical, thick, rigid, dull green, 15 in. long; scape slender, 3 ft. high, much branched and many-fl.; fls. nearly 1½ in. diam., dark green or olive-green, with indistinct darker spots; sepals clawed, undulate, crenate, obtuse, warted on the back, the upper one rotund, the others spatulate-oblong; petals larger and without warts; labellum reniform, almost plane. S. Amer. B.M. 3603. B.R. 727.—The panicle is said to grow to a height of 9 ft. A var. *roseum*, Hort., is said to have rose-colored fls., spotted with white and bordered with yellow. Var. *guttatum*, Lindl., has yellow fls. spotted with orange. B.R. 25:16.

45. *Papilio*, Lindl. BUTTERFLY ORCHID. Fig. 2581. Lvs. oblong, very leathery, olive-green, mottled with purplish brown, 6-8 in. long; peduncle 2-3 ft. long, flattened and jointed, producing fls. several years in succession; fls. 4-5 in. long and 2½ in. across; dorsal sepals and petals erect-linear, with a small lanceolate expanded portion, brown, with bands of yellow; lower sepals lanceolate-falcate, curved downward, yellow, with heavy bands of brown, labellum pandurate, usually plane, with the middle lobe rounded, transversely broadened, emarginate, yellow, with a broad band of brown around the margin; wings of the column toothed. Fls. at any season. W. Indies. B.M. 2795; 3733 (var. *limbatum*). B.R. 910. L.B.C. 11:1086. F.S. 9:920-2. P.M. 5:175. F.C. 1:12. F. 1842:49.—Variable in color of fls. and lvs. Lvs. sometimes green on the upper surface. Var. *Eckhardtii*, Lind. All parts of the fl. very large; sepals and petals golden yellow, barred with red; labellum yellow, with a broad margin of brown. I.H. 30:500.

46. *Kramerianum*, Reichb. f. This species is much like *O. Papilio*. Pseudobulbs rounded, 4-7-angled; st. terete; petals and dorsal sepals shorter than in *O. Papilio*, apex more distinctly dilated; lateral sepals golden yellow, spotted (not banded) with cinnamon-brown, crisp, undulate, finely toothed; labellum very crisp and undulate, finely toothed, pale yellow, with a narrow band of cinnamon-brown spots around the margin; column-wings entire. Cent. Amer. F.S. 19:1956. I.H. 41, p. 206. Gn. W. 20:738.

47. *Jonesianum*, Reichb. Plants with fleshy, rush-like lvs. 3-12 in. long and usually hanging downward; fl.-sts. 6 in. to 2 ft. long, the largest bearing about a dozen fls. 2 in. across; sepals and petals oblong, wavy, cream-colored, with sepia-brown spots; labellum white, yellow at the base, with a few crimson spots near the isthmus; middle lobe large, subreniform, 2-lobed, wavy; lateral lobes toothed. Fls. at various seasons. Paraguay. B.M. 6982. R.B. 15:7. Gn. 31:148.—The handsomest of the round-lvd. species.

48. *Cebollëta*, Swartz (*O. juncifolium*, Lindl.). Pseudobulbs very small, each with a single, terete, obscurely furrowed lf.; lvs. 1 ft. long, spreading, harsh in texture; panicle rigid, erect, about 2 ft. high; sepals and petals nearly equal, obovate, greenish yellow, spotted with red; labellum large, bright yellow; lateral lobes broadly obovate; middle lobe broadly obovate or subreniform, undulate, notched in front. Spring and summer. Brazil. B.M. 3568. B.R. 1994; 28:4 (as *O. longifolium*).

49. *triquëtrum*, R. Br. (*Cymbidium triquëtrum*, Swartz. *Epidëndrum triquëtrum*, Swartz). Pseudobulbs none; lvs. few, 4-6 in. long, triquetrous and grooved; scape about as long as the lvs., purplish, bearing a raceme of 10-12 medium-sized fls.; sepals broadly lanceolate, the lower pair united, purplish green; petals ovate, white, tinged with green and spotted with purple; labellum cordate-ovate, constricted near the middle, white spotted with purple; crest orange. Autumn. Jamaica. B.M. 3393.



LXXVII. Onion.—The Prizetaker, a handsome pale yellow popular variety.

O. abortivum, Reichb. f. Greater number of fls. abortive; perfect fls. pale yellow with chestnut-brown markings. Venezuela. G.C. III. 46:322.—*O. anfractum*, Rolfe. Scapes rather slender, about 3 ft. long; fls. bright yellow, with dark brown bars on sepals and petals. Venezuela.—*O. ansiferum*, Reichb. f. Sepals and petals oblong-ovate, free, crisp; labellum with ligulate lateral lobes and a reniform, emarginate middle lobe, golden yellow, with 2 dark brown bars at the base, flaccid. The sepals and petals are greenish, with yellow tips. Colombia.—*O. anthocrene*, Reichb. f. Fls. yellow, brown-barred, fragrant; sepals cuneate-oblong, undulate-crisped, acute, about equaling the petals; lip with lateral lobes deflexed, the isthmus narrow, the front lobe broad, reniform, 2-lobed. Colombia.—*O. armillare*, Lindl. Sepals and petals lanceolate, acuminate; crest of 3 flexuous keels. Peru. Gt. 7:296.—*O. Balderiana*, Reichb. f. (*O. Balderiana*, Reichb. f.). Panicle ample; dorsal sepals rounded, clawed, crisp, yellowish olive-brown with a yellow border; lower sepals longer clawed, cuneate-oblong, unicolorous; petals oblong, short-clawed, crisp, nearly complicate, smaller than the sepals, yellow, with brown blotches; labellum hastate, ligulate, obtuse. Summer. Colombia.—*O. Ballii*, Rolfe. Scape about 12 in. long; panicle about 7 in. long, many-fld.; fls. small, bright yellow with brown markings on lower half of sepals and petals; base of lip dark shining brown. Habitat (?)—*O. Beyrodtianum*, Schlecht. Allied to *O. varicosum* and *O. flexuosum* but distinguished by the crest of the lip, which is simple, quadrate-rounded, and scarcely warty above the base.—*O. bicolor*, Hort. ex-Lindl.—*Odontoglossum* sp.—*O. bidentatum*, Rolfe. Scapes slender, about 6 ft. long; fls. medium-sized, yellow marked with brown. Ecuador.—*O. bifolium*, Sims. Fls. yellow, the dorsal sepal and petals brown-barred, undulate, the lateral sepals united below; lip broad, reniform, 2-lobed. Argentina. G.W. 10, p. 80.—*O. caesium*, Reichb. f.—*O. Geertianum*,—*O. caloglossum*, Reichb. f. A supposed natural hybrid between *O. Marshallianum* and *O. Forbesii*. Sepals and petals yellow, with dark brown stripes nearly confluent on the petals. Brazil. Var. *concolor* is a yellow-fld. form.—*O. cardochilum*, Lindl. Panicle large, lax-branched; fls. numerous, about 1½ in. across; sepals and petals brown; lip yellow. Colombia.—*O. Charlesworthii*, Hort. (supposed to be natural hybrid). Fls. racemose, chestnut-red, lip yellow at base. G.C. III. 45:377.—*O. Clavii*, Rolfe. Sepals bright chocolate-red; petals and lip deep carmine, shaded with violet. Colombia.—*O. corynephorum*, Lindl. Sepals and petals rounded, undulate, light rosy purple, broadly white-margined; lip orbicular, deep violet-purple with a yellow base. Peru. G.C. III. 38:340.—*O. cristatum*, Beer=Odont., cristatum.—*O. Förstermannii*, Hcrt.=(?).—*O. fuscum*, Reichb. f.—*Miltonia Warszewiczii*.—*O. Gardneri*, Lindl. (*O. Gardnerianum*, Hort.). Resembles *O. crispum* and *O. Forbesii*. Fls. lemon-yellow, spotted and barred with chestnut-brown on the sepals and petals; labellum broad, yellow, margined with the same color, all segms. undulate, crisp. Brazil. G.C. II. 16:86. F.M. 1880:401. J.H. III. 47:415; 56:489. This is probably *O. curtum*, Lindl., which should be referred to this species.—*O. Geertianum*, Morr. (*O. caesium*, Reichb. f.). Species probably based on a variety of *O. reflexum*.—*O. graminifolium*, Lindl. (*O. Wrayae*, Hook.). Fls. panicle, yellow; sepals and petals blotched with deep brown, oblong-elliptic, acute; lip large, broadly obovate, lobed. Mex. B.M. 3554.—*O. Gravesianum*, Rolfe. Pseudobulbs broadly oblong-compressed, 3 in. long; lvs. elliptic-oblong, 4 in. long; panicle large, branching; fls. 2 in. across, yellow, spotted with brown; dorsal sepals spatulate; lateral sepals lanceolate-oblong, united at base; petals obovate, wider than the sepals; labellum pandurate, with small spatulate lateral lobes and a broadly orbicular-ovate, undulate middle lobe. Brazil. R.B. 21:73. G.C. III. 11:651. Near *O. crispum*.—*O. hastatum*, Lindl. Sepals and petals yellow, spotted with brown; labellum pale yellow. Mex.—*O. hybridum*=*O. tigrinum* × *O. lamelligerum*.—*O. ilicifolium* is a supposed natural hybrid between *O. leucochilum* and *O. maculatum*.—*O. Janssenii*=*O. tigrinum* × *O. Forbesii*.—*O. Jahnianum*, Schlecht. Lip 3-lobed, shorter than sepals, lateral lobes very obtuse, about ¼ in. long. Brazil.—*O. lamelligerum*, Reichb. f. Fls. large; sepals light brown, margined with yellow; petals very crisped, light yellow; lip narrow, light yellow, stained with purple. Ecuador.—*O. lancifolium*, Lindl. (*O. sessile*, Lindl. & Paxt.). Pseudobulbs oblong; lvs. abort, pale green; panicle much branched and bearing a large number of fls.; sepals and petals large, obtuse, yellow, spotted with cinnamon-brown at the base; labellum large, of the same color. Ecuador.—*O. Lavenderi*.—*O. Lawrenceanum*, Reichb. f.=*Brassia Lawrenceana*.—*O. Leopoldianum*, Rolfe. Fls. panicle, numerous; sepals and petals white, with a large purple spot; lip violet-purple, the disk yellow. Andes. G.M. 48:711.—*O. Lövi* is a supposed natural hybrid. Infl. over 6 ft. in length; fls. numerous, yellow spotted with brown.—*O. Mantini* is a supposed natural hybrid between *O. Marshallianum* and *O. Forbesii*. Sepals and petals yellow, centers covered with rich chestnut-brown; lip clear yellow, with few purplish brown spots. Var. *Lövi*, Hort., has the fls. unusually large.—*O. McBeanianum*=*O. superbiens* × *O. macranthum*.—*O. microchilum*, Batem. Fls. colored like *O. crispum*, panicle; sepals free, and, like the petals, oblong, undulate, and retuse; lip nearly round, cordate, barely half as long as the sepals. Guatemala.—*O. Mülleri*, allied to *O. corynephorum* and perhaps a form of it. Sepals and petals white, tinged with rose; lip rose-purple, with a cream-yellow crest. Peru.—*O. murinum*, Reichb. f. A species with numerous small yellow fls. borne in panicles.—*O. oblongatum*, Lindl. Fls. yellow; petals flat, undulate, with a few reddish brown basal bars. Mex.—*O. ohyzium*, Reichb. f. & Warse. Fls. golden yellow, spotted with brown, borne in a much-branched panicle. Peru. Said to be an elegant winter-flowering orchid.—*O. platylobum*, Regel. Panicle about 4 in. long; fls. rather crowded; sepals and petals obovate-oblong, olive-yellow; lip yellow. Brazil. Gt. 52:1518.—*O. pulchellum*, Hook. Fls. racemose; sepals and petals whitish, the lateral sepals united; lip large, quadrate, 4-lobed, flushed with rose and with a few yellow spots. Jamaica. B.M. 2773.—*O. punctatum* is a supposed natural hybrid

between *O. Forbesii* and *O. Gardneri*.—*O. Reichenbachii*, Lindl. Colombia.—*O. Rivierianum*, Hort. Peduncle about 2½ ft. long, bearing 15–20 fls.; sepals lanceolate, white, spotted with brick-red and black; lip golden-yellow, spotted. Brazil.—*O. robustissimum*, Reichb. f. Fls. panicle; sepals and petals yellow at top, brown at base; lateral lobes of lip serrate, the front lobe emarginate, marked with cinnamon bars. Brazil. G.C. III. 38:45.—*O. roseum*, Beer=Colchioda rosea.—*O. rupicola*, Lindl. Fls. numerous, in a branched panicle 2 ft. high, brilliant yellow, spotted with brown. Peru. Said to be desirable.—*O. Russellianum*, Lindl.=*Miltonia Russelliana*.—*O. Sanderi*, Rolfe. Lvs. brown-marbled; fls. on a long scape; dorsal sepal linear-lanceolate, acute, reddish brown, about 3 in. long, the lateral sepals oblong, crisped, yellow, brown-spotted, a little shorter, nearly 2 in. wide; petals linear-lanceolate, similar to dorsal sepal; lip 3-lobed, the lateral lobes rounded, crisped, yellow, brown-spotted, the middle lobe orbicular, clawed, crisped, about 1½ in. across. Peru. B.M. 8374.—*O. sarcodes*, Lindl. Pseudobulbs sub-cylindrical, 3 in. long, 2–3-lvd.; lvs. lanceolate; panicle branched, many-fld.; slender; fls. large, yellow, spotted with brown; sepals free, obovate; petals larger, clawed, obovate-spatulate, repand; labellum with small serrate lateral lobes; middle lobe large, emarginate, undulate. Brazil. I.H. 21:165. J.H. III. 58:92. Near *O. ampliatum*. Var. *ornatum*, Hort., differs in the color of its fls.—*O. Schillerianum*, Reichb. f. Trop. Amer.—*O. Schlumii*, Lindl. A large, rampant species, with yellow fls. marked with brown, about 1 in. diam. Nov. Cent. Amer.—*O. Stänleyi*, Hort., is a natural hybrid supposedly between *O. Marshallianum* and *O. curtum*. J.H. III. 53:267.—*O. stelligerum*, Reichb. f. Sepals and petals oblong-ligulate, stellate, yellowish, with many brown dots; labellum with short, obtuse-angled lateral lobes, a narrow isthmus, and a cordate, rotund, cuspidate middle lobe, pale yellow, with a darker callus. Mex. Near *O. hastatum*.—*O. Tälöur*, Reichb. f. Venezuela.—*O. Warszewiczii*, Reichb. f. Pseudobulbs rounded, compressed; lvs. 1 ft. long, thin; scape stout, with an 8–13-fld. panicle; fls. yellow, with purple spots and the middle of the labellum blood-red; upper sepals lanceolate, acute, crisp; lower pair oblong, shorter than the labellum, united; petals oblong, much wider than the dorsal sepals; labellum with auriculate lateral lobes, and a reniform bifid middle lobe. Colombia.—*O. Wiltonii*, Hort.=*Miltonia Warszewiczii*.

HEINRICH HASSELBRING.

GEORGE V. NASH.†

ONCÔBA (Arabian, *onkob*; name of a North African species). *Flacourtiaceæ*. Glasshouse woody plants, grown sometimes for the bloom.

Tropical and subtropical shrubs or small trees, sometimes spiny; lvs. alternate, without stipules; fls. terminal, solitary or clustered, white, reddish or yellow, large for this family, polygamous; sepals 3–5 and petals 5–10; stamens very numerous, inserted in many rows beneath the ovary; filaments filiform; anthers linear, 2-celled, attached to the base, erect, opening at the sides; stigma dilated, notched; ovary free, 1-celled; style cylindrical; berry leathery, pulpy within; seeds 1, few, or many, sometimes used as ornaments by the natives.—Species 25 or more, Trop. Amer. and Trop. Afr., also S. Afr.

Kraussiana, Planch. A branching shrub without thorns, young lvs. and shoots slightly pubescent, the older branches having a rough ash-colored bark; lvs. elliptic-oblong to oblanceolate, obtuse or subacute, entire, 2 in. long, with midrib, pinnate and netted veins, somewhat pale on under side; peduncles terminal or opposite the lvs., 2–3 in. long; fls. erect, solitary, about 2 in. across, white; sepals roundish and very concave; petals twice as long, spreading, with narrow claws, cuneate at base, broadly obovate, with scattered, woolly hairs; anthers pointless; stigma 5–6-rayed; ovary hairy. Procurable in S. Calif.—This makes a very fine pot-plant in greenhouse temperature, flowering in spring. It is also useful for subtropical bedding. Prop. from ripewood cuttings, also from seeds. Give the plant a sunny position, and plenty of water while new growth is making.

Routledgei, Sprague (*O. spinosa* var. *Routledgei*, Hort.). Shrub, to 20 ft., with strong axillary spines; lvs. alternate, short-petioled, oblong or elliptic-oblong, crenate-serrate, nearly glabrous; fls. white, fragrant, about 2 in. across, one or two together on the old wood; sepals 4, reflexed under the fr.; petals about 8; stamens very many. Trop. Afr. G.C. III. 49:322, 330. G.M. 54:277 (as *O. speciosa* var. *Routledgei*). L. H. B.†

ONCOSPÉRMA (Greek, *tumor-shaped seed*). *Palmaçæ*, tribe *Arceæ*. A group of little-known palms not in cultivation in America outside of botanic gardens.

Trunk low, very spiny: lvs. equally pinnate; lfts. ensiform-acuminate, entire, equidistant or somewhat clustered in 2 or more series, the veins scaly beneath; rachis convex on the back, with a blunt keel above; spadix from between the lvs., monocious, crowded with sessile, spirally arranged fls.; fr. small. *Oncosperma* differs from *Euterpe* in the small, acute sepals; stamens 6-12, the anthers erect; albumen ruminate.—Species 6. Trop. Asia. Cult. as in Areca.

fasciculata, Thwaites. Caudex at length 30-40 ft. high, 5-6 in. diam.; lvs. 18 ft. long; pinnae fascicled, 12-18 in. long, 1-2 in. wide, lanceolate, long-acuminate, the tips drooping; sheath 2½ ft., armed and scurfy; fr. globose, black-purple, ½ in. diam., much like a black currant. Ceylon.

filamentosa, Blume (*Arca Nibung*, Griff. *A. tigil-laria*, Jack). Trunk 30-40 ft., armed with long black spines; lvs. 10-12 ft. long, drooping; lfts. 2 ft. long, narrow, acuminate, scurfy beneath; fr. spherical, ¾ in. diam. Malaya. N. TAYLOR.†

ONION. All the onions of common or general cultivation are forms of one variable species, *Allium Cepa* (see *Allium*, Volume I). It is probably native to southwestern Asia, but it has been long domesticated and has varied much. Other cultivated species are *A. fistulosum* (Fig. 2583), *A. Porrum* (Fig. 2484), and *A. Schanoprosum* (Fig. 2585).

The onion is grown primarily for its bulbs, but the leaves are sometimes used as seasoning and in stews. Under long-continued cultivation and selection, the bulbs have developed into large and shapely organs. Now and then the bulb does not develop and the neck (or stalk just above the bulb) remains relatively thick: such onions are "scullions." Seeds from poorly selected or deteriorated stock may be the cause of scullions; they are to be considered as reverted or run-down forms. Sometimes scullions result from very wet soil, whereby the plants grow too much to top. Seeds grown in the South or in a long-season climate tend to produce plants in short-season regions that do not "bottom" before caught by frost.



2582. Onion in flower.

The onion is one of the hardiest of vegetable-garden plants. In the southern climates it is grown largely as a winter crop. In the northern states and Canada the seeds are sown or the bulbs planted as soon as the ground can be fitted in the spring. It is always best, if possible, to prepare the ground in autumn in order that

the seeds may be sown on the first approach of warm weather. When onions are grown from seeds, it is essential that the ground be fine and loose, and all surface stones and litter removed. The seeds are small and do not germinate quickly. The young plants are surface feeders. If the seed is sown late or if the ground is droughty, the plants will either perish or make no



2583. Welsh onion—
Allium fistulosum.



2484. Leek—*Allium Porrum*.

headway. Land that is foul with weeds should not be planted to onions, for the young onion plants cannot withstand such competition. In the old-fashioned gardens, it was the custom to plant onions in short rows crosswise of raised beds. This entailed an endless amount of small hand labor and usually resulted in the expenditure of more time and effort than the onions were worth. The better method is to grow the plants in long rows which are far enough apart to admit of the use of a wheel-hoe. Even when a small quantity of onions is desired, it is better to place them all in one row than to have many short rows. With the best of land and management, and with the use of wheel-hoes, more or less finger work will be necessary in order to bring the crop to full perfection. The seed may be sown thick in the home garden, and as the young plants begin to crowd, they should be thinned. The plants taken out in the second and third thinnings may be used on the table (Fig. 2586). It is very important that the best grade of seed be used, for the onion deteriorates rapidly from seed which is not well grown nor carefully selected. There are great numbers of varieties. For early use and for variety, great numbers of kinds may be selected from reliable seed catalogues. Some of the quick-growing southern onions are excellent for early use. Forms of onions are shown in Fig. 2587.

There are two general methods of propagating the onion—by seeds and by bulbs. Onions grown from seeds are ordinarily called "black seed onions," although there is no onion seed that is not black. The main field crop is grown from seeds, as explained in the articles which follow. The onion seed of the market is produced from full-grown and typical bulbs of the desired variety. These bulbs are grown from seed and are kept over winter as other onions are. In the spring they are planted in rows 2 feet apart and as near together in the row as they will stand. They send up a flower-stalk which blooms in early summer (Fig. 2582), and the seed is harvested.

Propagation by bulbs is employed for the purpose of securing early onions for home use or for the special early-season trade. Until within recent years, all the

very early or bunch onions were raised from bulbs, but recently a so-called "new onion-culture" has come into vogue, which consists in sowing seeds in hotbeds or coldframes and transplanting the young plants. Bulb-propagation is of three general categories: (1) The use of bulbets or "top onions" which appear on the top of

the flower-stalk in the place of flowers; (2) the use of bulbets or separable parts of an onion bulb, known as "multipliers," or "potato onions;" (3) the use of ordinary bulbs which are arrested in their growth, known as "sets."

Bulbets, or top onions, are shown in Fig. 2588. If one of these bulbets is planted in the spring, it quickly produces a young bulb, and the growing bulb may be pulled at any time and eaten. If allowed to remain in the ground, however, it sends



2585. Chive.—*Allium Schoenoprasum*.

up a stalk (either the first or second year) which bears a cluster of bulbets, sometimes mixed with flowers, on its top. There are two or three strains of top onion on the market, although the leading ones are the white and the red, these names applying to the color of the bulbets. The so-called "Egyptian onion" is a top onion; also the "tree onion."

Multipliers are shown in Figs. 2589, 2590. Instead of containing a single "heart" or core, as in most onions, it contains two or more. When the onion is planted, each of these cores or bulbets sends out leaves and grows rapidly for a time; that is, the old or compound bulb separates into its component parts. The growing bulbets may be pulled and eaten at any time. If allowed to remain in the ground, each of these bulbets will make a compound bulb like that from which it came. Sometimes flower-stalks are produced from multiplier or potato onions. The best results with multipliers are secured when the bulbets are separated on being planted, for each one has room in which to grow. Two or three kinds of multiplier onions are known, the variation being chiefly in the color of the bulb.

Onion sets are merely ordinary onions which are arrested in their growth, and when planted will resume growth. They are grown from seed. The seed is sown very thick on rather poor land, so that the young bulbs soon reach the possibilities of their growth; they mature when still very small. These small bulbs or sets are then harvested and kept over winter, and used for planting the following spring. When planted, they grow rapidly and may be pulled and used for the table. If allowed to remain in the ground, they send up flower-stalks and produce seeds as do common onions. Sets are not allowed to seed, however, since the seeds from sets would probably produce an inferior race of onions. Any variety of seed-bearing onion may be grown and propagated as sets, although there are relatively few that give uniformly good results. In the trade, onion sets are usually designated as yellow, red, or white. In order to secure good results from onion sets, it is essential that the sets be small and firm. They should not be over $\frac{1}{2}$ inch in diameter, if they are of the best. If they are much larger than this, they tend to run to seed rather than to produce bulbs. Sometimes the very small and inferior onions are saved from the regular crop and are used as sets the following spring. Such sets are generally known as "rareripes." Usually they do not give the best results.

The varieties of onions are numerous. Some of the forms of bulbs are shown in Fig. 2587. In 1889 ("Annals

of Horticulture") seventy-eight varieties of "seed" onions were offered by American dealers, and also about twenty kinds of multipliers, potato onions, and sets. For purposes of careful scientific study, the varieties may be classified into geographical races, but for purposes of description they may be assembled into groups characterized by such arbitrary features as form and color of bulb. Goff (Sixth Report of New York State Experiment Station, for the year 1887) classifies first by shape of bulb and then by color. He makes four primary groups: bulb oblate, spherical, top-shape, oval or pear-shape. Each of these groups is divided in three sections: color white, yellow or brownish, red or reddish. Another classification (Bailey, Bull. No. 31, Mich. Agric. College, 1887) makes three primary sections on methods of propagation: propagated by division (multipliers), by bulbets or "tops," by seeds (or sets). The last section (seed onions) is divided into bulbs silvery white and bulbs colored, and these groups are again divided on shape of bulb.

When onions are grown continuously on the same land they are likely to become seriously affected with smut. Rotation of crops is the fundamental remedy. Sulfur and lime drilled into the soil with the seed at the rate of one hundred pounds sulfur and fifty pounds air-slaked lime to the acre, is also helpful. The smut may kill the young onion plants outright. The onion mildew causes wilting or blighting of the leaves, without the black pustules caused by the smut. Bordeaux mixture is the standard remedy; a "sticker" should be added to the mixture.

Aside from the chapters on onions in the vegetable-gardening manuals, there are special treatises, as Greiner's "Onions for Profit," and "The New Onion Culture;" Greiner and Arlie's "How to Grow Onions," the Orange Judd Company's "Onion Book," Gregory's "Onion Raising;" J. P. Underwood's "Onion Culture."

L. H. B.

The new onion-culture (transplanting process).

The idea of raising onions by growing seedlings in beds and transplanting to the open, which are the essential features of what has been termed "the new onion-culture," is not new. It has long been put in practice in the Bermudas, among the Portuguese growers in California, and in various places in Europe. This, however, does not detract from the fact that the writer, as well as W. J. Green, of Ohio, rediscovered (about 1889) this old plan or method of onion-growing, which was then unknown in their localities and also in most parts of the United States. There are only few, if any, modern innovations which have left an equally deep impression on our garden practices. The transplanting method is admirably adapted



2586. Bunch onions from the early spring sowing.

to the character of the large foreign onions, especially those of the Spanish type, and by it the American grower is enabled to produce bulbs in every way the equal of those large sweet onions which are imported from Spain and other foreign countries, and sold in our groceries at 5 to 10 cents a pound. Some of the onions now sold to the unsuspecting buyer in various places as "imported Spanish" may be really nothing more than these home-grown bulbs of the Prizetaker variety, and the buyer is not the loser by any means. This Prizetaker is perhaps the best of this class of onions to be grown by the transplanting process at the time of writing—large, of good shape, perhaps a little darker in color than the imported Spanish, and its equal in mildness of flavor. The newer Gibraltar is still larger, milder, a little later, not so good a keeper, but altogether one of the best onions which the home-

Commercial onion-culture in the North.

The soil for onion-culture should be a rich, moist, but not wet, loam with a subsoil of clay, or close compact sandy loam, not coarse gravel, as that lets the water leach out too quickly. Onions will stand a large amount of fertilizing, and there is little danger of getting the soil too rich. Soil that has been under cultivation for three or four years at least is much better than new land. The tendency of the latter is to produce too much top-growth and improperly ripened bulbs.

To prepare the soil, plow 10 or 12 inches deep, if the soil is of sufficient depth, or down to the subsoil. Care should be taken not to turn up much subsoil, or the crop will not mature evenly.

If the soil is poor, plow in 5 to 10 cords of stable manure to the acre, and spread on an equal amount of well-rotted manure after plowing, to be harrowed in. Unleached hardwood ashes is also a good fertilizer, especially on rather dry land, as it aids in the conservation of moisture. The action is quick, which makes it valuable where a little of the subsoil has been turned up in plowing, giving the young plants a good start, when, without it, they would be too light-colored and weak in growth. Ashes should be spread as evenly as possible, seventy-five to one hundred bushels to the acre on the ground after plowing, and harrowed in.

The harrowing should be thorough, using some kind of a disc or spring-tooth, for the first time over, with a Meeker or some other smoothing-harrow for the finish. It is impossible to get a good even stand of plants if the ground is rough or lumpy, while those that do grow are weak and puny on rough ground. Hand-raking is sometimes necessary to insure germination of seed in a satisfactory manner.

The drainage must be nearly perfect, to get best results. There should be no hollow places in the beds. Even on a sloping piece of land, the dead-furrows or alleys should be kept open to a depth of 8 or 10 inches, and evenly graded so the surplus water will all drain off. If there is a natural sag in the land which cannot be surface-drained, it is often practicable to underdrain so as to get satisfactory results; for there is no crop grown in the ordinary market-garden which will pay a larger percentage of return for underdraining, in nearly all locations. If the foliage is of a light color, and the crop does not ripen evenly, an underdrain will usually correct the trouble. The time to drain is when the ground is being prepared for planting, not after a heavy rain, when water is standing in pools over the field.

The time to plant is as early in the spring as the soil becomes in good working condition. The common spring frosts and snow flurries will do no harm if other conditions are right.

There are a few growers who can profitably grow their own seed, but the masses should buy. This should be done early, so that there may be no delay at planting time, and also that one may get the best stock obtainable. If one wants ten pounds or more, it is sometimes advisable to order from some one of the large seed houses of the country, but if there is a reliable local dealer who buys seed in bulk, one can often do better than to send direct to the large seed house, even on quantities of fifty to one hundred pounds. Be sure to know where the seed comes from, and if possible test it before planting. In any case, always buy the best seed obtainable, no matter if it costs double the price of other stock.

The sowing of the seed should be done with one of the standard garden seed drills, the first essentials of which are that the machine can be regulated to sow evenly and in the quantity desired without clogging. The machine should open a row, sow, cover, roll, and mark the next row, all at one operation. The machines which have a sliding piece at the bottom of the hopper, which opens



2587. Forms of onions. 1, flat; 2, long globe; 3, globe onion; 4, oblong; 5, oblate.

grower, as well as the market-gardener who can sell his crop before late fall and at good prices, could produce.

The plants should be started under glass (preferably in greenhouse) during January or February, sowing seed rather thickly in drills $\frac{1}{2}$ or 2 inches apart, and using about an ounce of seed to 10 square feet of bed-surface. The soil should be sandy and very rich. Keep the plants in good growth, and as soon as the patch outdoors can be properly prepared in spring, set the seedlings in rows about 14 inches apart, and from 3 to 4 inches apart in the rows. Little hand-weeding will be necessary, but the wheel-hoe should be used freely. Green or bunching onions are also often grown in this way. For that purpose the plants are set more closely in the rows, not over 2 inches apart. Seed of the Prizetaker is mostly grown in the United States, while that of others is as yet all imported.

T. GREINER.

and closes a diamond-shaped opening, are the best, as the operator can regulate exactly the amount of seed sown.

The seed should be sown in rows 12 to 14 inches apart, and at the rate of three and one-half to four and one-half pounds to the acre, according to soil and seed. A soil which produces heavy tops requires less seed



2588. Top onions. ($\times \frac{1}{3}$)

than the drier, sandy soil which grows small tops. The plants should stand from 1 to 3 inches apart in the row. The seed should be sown from $\frac{1}{2}$ to 1 inch deep, according to soil.

Cultivation should begin as soon as the plants are up enough for the rows to be seen. Begin with a double-wheel straddle cultivator if one is at hand, setting the knives as closely as can be worked without covering the young plants, and continue as often as necessary to keep weeds destroyed and the ground loose on top until the plants are too large to get through. The last time through may be done with a single-wheel machine, which will throw a little earth up to the plants. A single-wheel machine may be used throughout the season, but the double-wheel is preferable for the first part of the work.

On light soil, a hand-weeder may be used with profit after the young plants have reached 3 to 5 inches in height. This works two rows at one passage, stirring the soil in the rows where the wheel-hoes do not work, and greatly reduces the amount of hand-weeding to be done. Of course, hand-weeding must be done as often as necessary to keep the beds clean.

Harvesting may be done in the following manner: If the crop ripens evenly, so that there are no green tops standing, the topping can be done most rapidly before the onions are pulled. By using a thin, sharp knife, taking the dry tops in one hand and cutting from the person, the work can be done quickly and well. Be careful not to tear the skin down the side. The length to cut the tops is a point of importance and must not be overlooked. If the tops are left too long they have a ragged appearance, and if too short, there is danger of causing the onions to rot in the tops, because of bruising or because of water having gone to the inside of the onions. The proper length is about $\frac{1}{2}$ inch from the bulb; or, take an onion by the top, with the thumb and forefinger close to the bulb, and cut the top close to the fingers. The pulling may be done by hand, but a

puller made to fit a hand-cultivator is much more rapid and does not injure the bulbs. The puller is simply a curved knife with one or more fingers to move the bulbs slightly after the roots are cut. In light dry soil it works very well without any fingers.

Many growers prefer to pull the onions first, allowing them to dry a few days before topping. This is what should be done if the tops do not dry evenly, or if the crop is late and needs to be hurried; and is all right in any case, though not quite so rapid as the other way.

After the onions are topped, they should be gotten under cover as soon as possible. Let them dry a day or two if the weather is favorable and then pick them up and store in the curing-shed. If allowed to lie too long on the ground the skin peels off too much. The shed should have doors or ventilators at each end from top to bottom, so that the air can pass through freely and be free under the floor. If the floor is tight, with no circulation under it, lay some 2 by 4 scantling on the floor and lay a loose board floor over them without nailing; then take some pieces of 2 by 4 sawed just 1 foot long and nail them to the floor at even distances for posts to carry stringers for the next floor. Use 2 by 4 for the stringers; set them on edge, nail them to the posts and all is ready for the onions. This gives a space of 16 inches. Fill 12 inches (the length of the posts) and leave the 4 inches for air-space. Lay another floor and proceed as before, being careful to get the upper posts directly over the lower ones, or the stringers will break after two or three floors are in.

In handling the onions, bushel boxes are the most convenient. Pick them up in common baskets, leaving all small, defective, or odd-colored bulbs on the ground, to be picked up separately and sorted as occasion may require. Dump in the boxes, then drive along the side of the bed with a platform wagon, and load. Have a screen about 4 feet long by 2 feet wide made of narrow strips $\frac{1}{2}$ to 1 inch wide and about 1 inch apart and the sides 10 inches high. Put legs on one end about 14 or 15 inches long and on the other end long enough to give it a sufficient incline to make the onions roll down freely. With an old coffee sack, make a bag like a sheet hung by the corners with hooks, to hang under the screen, in order to catch the dirt and leaves. Carry the boxes of onions directly from the wagon to the screen and pour them over it, moving the screen back as the floor is filled to the proper depth. This will take out all the dirt and most of the loose leaves, and make the onions come out of the shed in much better shape. They should lie in the shed until they are dry enough to peel off another skin, and rattle and crackle when the arm is run in among them.

If all has gone well, the crop should average 500 bushels to the acre on good land, or 600 bushels on very rich land, and 700 or 800 bushels on a single acre selected from the best part of a 10-acre field.



2589. A multiplier onion.



2590. Section of a multiplier onion.

There is an old saying, "the time to sell is when someone wants to buy." This is a very good rule to apply, unless one is prepared for cold weather or is reasonably sure of an advance in price. In a general way, it is best to ship in sacks of even size and not too large, one and three-fourths to two and one-fourth bushels. These points must be governed by the market. In sacking to ship, always throw out all defective bulbs and all of

another color. In size, down to about $1\frac{1}{2}$ to $1\frac{1}{4}$ inches in diameter is a good scale to use in a general way, but this point must also be governed by the market. Sell by sample so far as possible.

There are three varieties of onions which take the lead clearly above all others in the big markets of the country,—the White Globe, Yellow Globe, and Red Globe. These come under different names, as Southport Yellow Globe and Michigan Yellow Globe, but the object in view among seed-growers is to get bulbs as nearly globe-shaped as possible. The skin should be thick and two or three layers deep, to prevent bruising.

IRVING C. SMITH.

Onion-culture in the South.

Twenty years ago onion-growing from seed was not considered practicable, and by many it was considered impossible south of the Potomac. The introduction of varieties from southern Europe and more careful attention to details of the work have made onion-growing not only possible but often exceedingly profitable.

The eastern South consumes large quantities of the mild forms, such as the Bermudas. In the markets at

Jacksonville, Florida, these are sold by the piece, frequently retailing at 5 cents and 10 cents each. The southern onion-grower must keep in close touch with the northern and foreign onion markets. In the humid regions of the South, there is a considerable risk from unseasonable rains. In the drier regions, such as a part of Texas, it becomes a very important and remunerative form of vegetable-growing. They have developed onion-growing most extensively and have organized the marketing arrangements most perfectly there.

The soil should be alluvial, sandy, and of a fine texture. A level tract, freed of all debris, and one that can be plowed deeply, is

desirable. In the coast regions such land may be obtained in great abundance. It is frequently used for vegetable-growing, but large areas are still uncleared or are used for farm crops. In the hilly regions of the interior, onion lands must be sought mainly along rivers or old river-beds.

Undecomposed vegetable matter should not be applied immediately preceding the crop. Even cotton-seed meal should be used three weeks or more before the seed is sown and then carefully incorporated with the soil where the rows are to be, or if the rows are to be a foot or 14 inches apart the cotton-seed meal may be sown broadcast and cultivated in.

Seed-sowing in the field occurs in the upper districts as early as the first of April or a little earlier, in the central district about the last of February, while in the Gulf region it may occur late in fall or any time during the winter, being gauged largely by the time required for the variety to mature, and the market to be met. It is a good rule to put on an abundance of seed, about twice as much as recommended in general, especially in the Gulf region. Many fields suffer from deficient stand more than from any other cause, and in some years it is the only cause for an unprofitable crop.

Good crops may be grown from sets, but the labor involved and cost of the "seed" is usually so great as to deter many from planting them. In using sets, they

should be separated into three or four grades, the largest size maturing earliest and the smallest last. In most cases the smallest sets grow such inferior onions that they had better be discarded. This takes for granted that the sets were all grown at the same time and from the same seed in one field.

Nearly all the onion sets used in the South are shipped in, while they may be grown as well here as anywhere. In the Gulf region there is time enough to grow a crop of sets after the northern crop has been harvested and marketed. Thus in case of shortage in northern-grown sets, it is entirely practicable to ship the seed South, grow sets, and ship sets back in time for spring market.

Much has been written and spoken about raising the plants in a seed-bed and then transplanting to the field. While this may be practised successfully, the greater quantity of onions is raised by the old-fashioned method, i. e., by seeding in the drills where the plants are to mature bulbs.

In certain localities it is advantageous to plant out a seed-bed before the general field will permit working, and then transplant as soon as all conditions are favorable. In the upper districts of the South, seed may be sown in hotbeds as early as the first of February, and the plants may usually be set out by the first of April. In the central South, seed may be sown in protected coldframes as early as the middle of December, or in an open bed in February. The earlier plants may be transferred to the field by the last of February, or as soon as danger from frosts is past. In the Gulf region the seed may be sown during the fall in an open bed, and transplanting to the field may occur when plants are of proper size and favorable condition of weather prevails.

Harvesting is often attended with considerable difficulty, and in some cases special drying-houses have to be constructed to secure the crop in first-class condition. The crop is a perishable one, and must be pulled, gathered and shipped in as short a time as possible, when sufficiently mature.

There seems to be no generally accepted plan for marketing, the crop being placed in boxes, barrels or bags for shipping.

The following varieties have given good crops in the hands of expert growers and may be recommended for the entire South: White Bermuda, Red Bermuda, Prizetaker, Yellow Danvers, Giant White Italian, Giant Rocco, and Large Tripoli. Other varieties than those named here have given as good or better returns, but do not seem to have been so generally successful. Additions are Red Bermuda (Fig. 2591) for Gulf region and Red Wethersfield for central and upper district.

Black mold (*Macrosporium Porri*) is a disease which spreads rapidly over the field, especially late in the season. Some good may be done by spraying with bordeaux mixture, but its application is limited almost to the diseased portion.

Another disease attacking onions is smut (*Urocystis cepula*). The name of this fungus describes it fairly well. About all that can be done is to subject the field to rotation, and to sow seed from smut-free districts. Some years nearly all southern-grown onions brought to market will be more or less infected.

Rotting is especially severe in wet seasons when the crop cannot be properly handled, and is caused by a number of fungi. The best preventive is to store in a dry place, and consume as soon as practicable.

Onion fly, or onion maggot, is one of the most severe pests when it enters the field. There seems to be but little encouragement in combating the pest. It often leaves the field as mysteriously as it appeared. This disappearance has been coincident with the application of some supposed remedy, and has consequently led to the recommending of unreliable remedies. A thorough application of ground tobacco stems down the row seems



2591. Red Bermuda.

to act as an insecticide and a repellent, besides being of value as a fertilizer.

Thrips attack the leaves at times, and become so numerous as to cause the tips to turn brown and finally destroy the whole leaf. Besides the insect injury they open the way for such fungi as *Macrosporum*. This insect may be treated successfully with kerosene emulsion, tobacco decoction, resin wash and possibly with kerosene-water mixture. P. H. ROLFS.

ONION, SEA: *Urginea maritima*; also applied to *Ornithogalum caudatum*.

ONÓBRYCHIS (Greek, *asses' food*). *Leguminosæ*. Among cultivated plants, this genus contributes the sainfoin, used for forage. The group yields little in the way of ornamentals.

Perennial, sometimes shrubby and spiny; lvs. odd-pinnate, with entire not stipellate lfts.; fls. purplish, rose-colored or whitish, in axillary peduncled spikes or racemes; calyx-lobes subulate, for the most part nearly equal; corolla papilionaceous, the standard obovate or obcordate and narrowed toward the base; wings short; keel obtuse, equaling or exceeding the standard; stamens 9 and 1; ovary 1-2-ovuled; pod sessile, flat and hard, 1-seeded and indehiscent.—Species 80 and more, Eu., N. Afr. and W. Asia. Closely related to *Hedysarum*, but differing in the 1-seeded or 1-jointed pod.

vicifolia, Scop. (*O. sativa*, Lam. *Hedysarum Onóbrychis*, Neck.). **SAINFOIN** or **SAINTFOIN**. **HOLY CLOVER**. **ESPARCET**. Perennial herb with ascending sts. 1-2 ft. long; lfts. many, oblong, somewhat downy or pubescent beneath and glabrous above; peduncle exceeding the lf., the spike lengthening; fls. pale pink (varying to white); pod twice exceeding the lf., strongly curved on the lower edge, with short teeth on the margin and sometimes prickly. Cent. and S. Eu., Temp. Asia.—Grown for forage. It requires a limestone soil, and in the U. S. is grown chiefly in the southern states, but it has never become agriculturally important in this country. The seeds are nutritious and are eaten by fowls. From 100-150 lbs. of seed are sown to the acre. L. H. B.†

ONOCLEA (Greek, *closed vessel*; alluding to the closely rolled sporophylls). *Polypodiaceæ*. A small group of coarse ferns of north temperate regions, with creeping rootstocks, anastomosing veins and two sorts of lvs., the segms. of the sporophylls being closely rolled about the sporangia into bead-like bodies. For *O. Struthiopteris*, see *Matteucia*.

Onoclea are tenacious of life, and will grow under almost any conditions, especially *O. sensibilis*, but they prefer a moist, rather heavy loam, in a cool but not necessarily shaded position. *O. Struthiopteris* (a *Matteucia*) in the sunny border is likely to burn during severe drought. It is a suitable deciduous fern for the greenhouse, and may easily be had in foliage before their natural season. (F. W. Barclay.)

sensibilis, Linn. **SENSITIVE-FERN**. Fig. 2592. A coarse, easily grown fern, a native species, with broad triangular lvs., growing in low, wet places. Sensitive only in that it does not stand frost.

L. M. UNDERWOOD.

ONÔNIS (old Greek name). *Leguminosæ*. **REST-HARROW**. Good plants for borders and rock-gardens, with clover-like leaves.

Annual, biennial or perennial, often shrubby; glabrous or villous; lvs. usually pinnately foliolate, the stipules attached to the petiole; fls. papilionaceous, yellow, purple, pink or rarely white, solitary, 2-3 in the axils or in peduncled racemes; calyx bell-shaped, 5-parted, deeply cut, narrow; standard large, striped; stamens united in a tube, the members sometimes partly free; pod usually swollen, few-seeded.—Some 70 species, Canaries, Medit. region, to Cent. and N.

Eu. A few of the perennial species are more or less in cult. They thrive under usual treatment; prop. by division and by seeds. Sometimes the lvs. are 1-foliate.

A. Fls. solitary or in groups of 2-3, rose-colored.

rotundifolia, Linn. A neat, attractive, shrubby, hardly plant 1½ ft. high; lvs. trifoliate; lfts. subrotund to ovate, serrate; peduncles axillary; racemes 2-3-fl.; fls. pea-like, bright rose, not bracted; standard striped with lines of a deeper shade. S. Eu. B.M. 335. G.L. 27:131.—Of easy cult. in border and rockery, not liking too much shade. Summer.

hircina, Jacq. (*O. altissima*, Lam.). Erect, spineless, more or less villous, 1-2 ft.; lfts. 3, oblong-lanceolate, acute, serrate; fls. about 2 together, rose and white, May-July or Aug. Eu.—A pretty plant for rather dryish borders and rocky places.

spinosa, Linn. Somewhat shrubby, spinose, the sts. more or less erect; lfts. 3, oblong with cuneate base, subentire; fls. solitary, rose-colored. Eu.



2592. Sensitive fern.—*Onoclea sensibilis*. Fruiting frond at A.

fruticosa, Linn. Sturdy compact little woody bush about 1 ft. high and becoming much broader; lfts. 3, to 1½ in. long, lanceolate and deeply serrate; peduncles about 3-fl. and collected into racemes or clusters; standard pale rose with central stripe, wings whitish suffused pink. Eu. B.M. 317. L.B.C. 16:1569. G.C. III. 47:420.—Excellent for rock-garden.

AA. Fls. solitary, yellow.

Natrix, Linn. **GOAT-ROOT**. **YELLOW-FLOWERED REST-HARROW**. Low, much-branched perennial; st. 1-1½ ft. high; lvs. trifoliate; lfts. elliptical or oblong, serrated near the apex or sometimes entire; stipules large; fls. axillary, the standard finely striped with red. Midsummer to fall. B.M. 329. M. B. COULSTON.

L. H. B.†

ONOPORDON (old Greek name). Sometimes written *Onopordum*. *Compositæ*. Coarse woolly Old World herbs. Stems stout (sometimes acaulescent), winged by the decurrent bases of the lvs., which are large, alternate, prickly, dentate or pinnately cut; involucre globose, the bracts imbricated in many series, and in some cases spiny; receptacle flat, fleshy, honeycombed, not bristly; pappus not plumose, but with bristles in several series.—About 12 species, annual and biennial.

A. Involucral bracts erect and appressed.

B. Sts. usually nearly simple, the heads often solitary.

arabicum, Linn. St. tall, swollen and deeply winged by the decurrent lvs.; branches numerous, short, erect; lvs. ovate-lanceolate, sinuate and spiny; fls. in dense,

solitary terminal heads, the infl. usually arachnose, as are the erect involucrel bracts. *Medit. region. B.M. 3299.*—A showy biennial with purplish red fls.

nr. Sis. mostly much branched, the heads corymbose or paniculate (solitary at the end of the peduncles in *O. Acanthium*).

Acanthium, Linn. **SCOTCH THISTLE**. Biennial, vigorous, much-branched, 3–9 ft. high; lvs. oblong, lobed and dentate, acute, the lower often 1 ft. long, cottony white, spiny; heads of pale purple fls. 1½–2 in. across, borne singly on the branches. *July–Sept. B.B. 3:491. Gn. 46, p. 9; 68, p. 157. G.W. 7, p. 425. R.B. 20, p. 200.*—The Scotch thistle is often called the cotton thistle; sometimes also Argentine, asses', down, oat, Queen Mary's or silver thistle. It is apparently not advertised in Amer., but is sometimes cult. for "auld lang syne," and occasionally it is used with striking effect by some lover of hardy plants. It is then placed against a background of dark shrubbery, which sets off the silvery foliage and bold habit. The plant is rarely found growing wild in the Atlantic States, having come from Eu. The Scotch thistle will probably never be a weed of the first importance in Amer., as is the Canada thistle. Nevertheless, care should be taken not to let it go to seed. A white-fl. Scotch thistle, var. *alba*, Hort., was advertised in Germany in 1894 as a horticultural novelty. *Gt. 45, p. 107.*

tauricum, Willd. An ornamental plant of tall stately growth and many-headed infl.: st. white-hairy; lvs. somewhat decurrent, elliptic-oblong, the margins wavy and spinose; involucrel bracts ovate-lanceolate, the tips subulate. *Russia and S. Eu. G.W. 7, p. 425.*—Perfectly hardy and only recently intro.

polycéphalum, Boiss. A densely tomentose, tall-stemmed biennial with grooved sts. and a many-headed corymb of showy fls.: lvs. somewhat lobed, spiny-margined, diminishing in the infl.: involucrel bracts pale, all erect, lanceolate.

AA. Involucrel bracts (outer) recurved.

bracteatum, Boiss. & Heldr. A tall tomentose much-branched biennial: lower lvs. oblong-lanceolate, the shallow lobes and often the margins tipped with yellow stout spines; cauline lvs. much smaller, decurrent, diminishing in the infl. to start short bracts: heads large, globose, the outside involucrel bracts recurved. *E. Medit. region.*—Probably not hardy northward.

O. Salteri, Hort. "Plant pyramidal in habit, about 5 ft. high, silvery shining. Lowest lvs. widely spreading on the ground, incised, spiny, upper reduced." Country unknown.

N. TAYLOR.†

ONOSERIS (*asses' salad*; significance not evident). Including *Isotypus*. *Compósitæ*. Some twenty herbs or shrubs, mostly Andean, but also in Mexico and southeastern Brazil, grown rarely indoors and out for the large purple, pinkish or white flower-heads; allied to *Mutisia*, but it has no close relatives of much horticultural importance.

Plants of various habit, mostly erect, sometimes annual, some species almost stemless: lvs. radical and cauline, white-tomentose beneath; heads large, heterogamous, solitary or panicle, the peduncles or scapes usually long and more or less bracted; ray-florets pistillate in one series (heads discoid in *O. Isotypus*); disk-florets usually hermaphrodite and fertile; involucre hemispherical or top-shaped, the bracts linear, imbricate and in many series, the exterior ones gradually shorter.—They appear to require no special cult. treatment; prop. by seeds.

O. adpressum, Less. (*Centroclinium adpressum*, Hook.). Little shrub, blooming under cult. at 1 and 2 ft., with woolly branches: lvs. lanceolate, reflexed, 3 in. or more long, nearly entire but undulate; peduncle solitary and terminal or becoming lateral by elongation of other shoots; head solitary, large, fragrant; rays long and narrow, about 8, rose-purple. *Peru. B.M. 3115.—O. Drakeana*, André. Woolly, little branched, often weak; lvs. alternate, ovate, lanceolate or hastate, entire or shallowly dentate; peduncles scape-

like, 1-headed, with few bracts; rays violet, about 20, showy. *Colombia. R.H. 1883:180.—O. Isotypus*, Benth. & Hook. (*Isotypus onoseroides*, HBK. *Caloseris rupestris*, Benth.). Showy shrub 3–5 ft. high, the branches white-lanate: lvs. long-petioled, large, broadly hastate-cordate, 5–8 in. long, acute, sinuate-lobed and dentate, 3–5-nerved, the petioles 6–10 in. long; heads about 1 in. long in a terminal panicle, the corolla red and scarcely exceeding the involucre. *S. Mex. Guatemala. G.W. 12, p. 11.—O. purpurata*, Willd. Nearly stemless perennial: lvs. radical, lyrate, the terminal lobe large and deltoid-hastate and dentate; scape branched at middle, 3-headed, the rays purple and short. *Colombia.—O. reflexa*, Less. (*Centroclinium reflexum*, Hook.). Woolly branched, about 2 ft., probably annual: lvs. ovate-lanceolate, 2–3 in. long, coarsely toothed and acute; peduncle solitary, terminal or from upper axils, with many small bracts; heads large and handsome, fragrant; rays 9–12, very narrow, rose-purple. *Peru. B.M. 3114.*

L. H. B.

ONÓSMA (*onos*, an ass, and *osme*, smell; the odor reputed to be liked by that animal). **GOLDEN DROP. Boraginaceæ.** Outdoor or border plants, grown for the small pretty flowers.

Bristly hardy perennial, annual and biennial herbs or undershrubs, with long narrow alternate lvs. and 1-sided simple or cymose bracted racemes: fls. yellow, purple, or white, tube-like, or urn-shaped, sessile or with short pedicel, with 5 very short corolla-lobes; calyx 5-parted or cut; corolla-throat dilated or contracted; stamens 5, inserted midway on corolla-tube, mostly included; ovary with 4 distinct lobes, the style filiform and stigma small; nutlets 4 or fewer, erect or incurved, smooth and shining or less frequently tuberculate.—Species 70, *Medit. region* and the Himalayas. They are adapted to borders and rock-gardens; of simple cult. requirements. The perennial kinds are increased by cuttings in summer, in a frame; the annuals and biennials by seeds. Most of the cult. species do not ordinarily much exceed 1 ft. in height and many of them are lower than that.

echioides, Linn. Biennial or perennial strigose herb, from a red root, blooming in spring, erect or rarely branched, 6–9 in. high or more: lvs. spatulate or linear-lanceolate, sessile, becoming cordate above; floral lvs. lanceolate to nearly ovate-lanceolate: fls. pale yellow to whitish, drooping, fragrant; corolla cylindrical or subelavate. *S. Eu. G.W. 6, p. 529.*

stellulatum, Waldst. & Kit. Perennial, branched at base, ascending, hispid: lvs. linear-oblong, plane, obtuse or the upper ones acute: fls. yellow, more or less cernuus, short-pedicelled, in bifid cymes; corolla 1 in. long and about ½ in. wide at apex, somewhat clavate, twice longer than calyx, the teeth very short and revolute. *S. and S. E. Eu. Variable; cult. chiefly in the var. tauricum*, Hort. (*O. tauricum*, Pall. *O. angustifolium*, Lehm.), with narrow revolute lvs. and citron-yellow fls., the corolla often 1½ in. long. *B.M. 889. J.H. III. 35:11. Gn. 50, p. 251. G.C. II. 16:21; III. 51:274. G. 4:447.* Succeeds well on high ground or on sunny rocky, with light, open, deep soil. Prop. by cuttings generally, or by seed.—Var. **compactum**, Hort., is a condensed form. *M.D.G. 1912:325. O. helveticum*, Boiss, is a Swiss form, not so tall and with rather broad lvs. *G.C. III. 52:280.*

albo-röseum, Fisch. & Mey. (*O. album*, Hort.). Perennial, more or less woody, tomentose: lvs. hoary, oblong and somewhat obtuse, narrowed to petioles, the upper ones sessile and lance-oblong: fls. white changing to rose and violet, velvety; corolla nearly 1 in. long, clavate pubescent, nearly double length of calyx. *Asia Minor.*

Förrestii, W. W. Smith. Perennial: basal lvs. linear-lanceolate or oblanceolate, 6 in. or less long, the st. lvs. linear and erect, all of them white-tomentose: infl. rather dense, thickly covered with whitish hairs, the fls. rose-color; calyx nearly ½ in. long, the narrow-tubular canescent corolla scarcely exceeding it. *Yunnan, China.*

O. sericeum, Willd. Perennial, somewhat woody, silky-pubescent: lvs. oblong-lanceolate to obovate, the lower ones narrowed to the petiole: fls. yellow, ¾ in. long, the corolla broad at apex and

exceeding the calyx. Orient. G.C. III, 52:281.—*O. Thompsonii*, Hort., is *Echium rubrum*, Jacq., of S. Eu. and Caucasus: lvs. white tomentose, linear-lanceolate: fls. scarlet, racemose.

L. H. B.†

ONOSMÔDIUM (like *Onosma*, a European genus of this family). *Boraginaceæ*. FALSE GROMWELL. About 10 species of N. American and Mexican branching herbs, mostly or wholly perennial, bristly, 1-4 ft. high, rarely transferred to cult. grounds: lvs. oblong, sessile, rib-veined: fls. white, greenish or yellowish, in long, erect, leafy, raceme-like clusters; corolla tubular or oblong-funnel-shaped, with throat naked, the lobes erect, acute, the sinuses more or less inflexed; style filiform or capillary, very long; stigma exserted before the corolla opens: nutlets ovoid or globular, bony, smooth and polished, white. Closely related to *Lithospermum*. None of the species seems now to be in the trade; the names and descriptions may be found in the manuals of native plants. They are of little value horticulturally.

ONTADÈNIA: *Odontadenia*.

ONÝCHIUM (Greek, *onyx*, a claw; referring to the shape of the lobes of the lvs.). *Polypodiaceæ*. A group of small mainly Asiatic ferns, with the sori arranged on a continuous linear receptacle as in *Pteris*, but with narrow segms. in which the indusia extend nearly to the midrib. For cult., see *Fern*. The orchids occasionally advertised as onychiums are dendrobiums.

auratum, Kaulf. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with membranous indusia and abundant sporangia of a golden color; divisions of the sporophylls pod-like. India and adjacent islands.

japonicum, Kunze. Fig. 2593. Lvs. ovate, a foot or more long by half as wide, quadripinnatifid, with pale indusia and brown sori; divisions of the sporophylls linear-mucronate, similar to those of the sterile lf. India, China, and Japan.

L. M. UNDERWOOD.

OPHÈLIA: *Svertia*.

OPHIÁNTHE: *Gesneria*.

OPHIOGLÔSSUM (Greek, *serpent's tongue*). *Ophioglossaceæ*. About 40 species of small plants allied to true ferns, of wide distribution. The sts. are subterranean, small, bearing usually a single erect succulent lf. which consists of a petiole, an expanded simple blade, and a

contracted fertile spike bearing 2 rows of fleshy coalescent sporangia; venation reticulate. Rather difficult of cult., and mainly of interest as curiosities.

vulgatum, Linn. ADDER'S TONGUE FERN. Fig. 2594. Lf. 6-12 in. high, the petiole 3-6 in. high, the blade ovate, 1-2 in. long, the spike about 1 in. long, on a long stalk. Spores mature in July. In low places, Eu. and N. Amer.—May be cult. in moist peat in a partially shaded spot. Occasionally found in large numbers in peaty meadows.

R. C. BENEDICT.

OPHIOPOGON (Greek, *snake's beard*; a translation of the Japanese name). *Liliaceæ*. Herbs, grown for the bluish or white small flowers and the grass-like foliage that may form a good ground-cover.

The genus is oriental, of about a score of species. The plants have a short thick rhizome, and the fibrous roots sometimes act like runners, and may be thickened into tubers: lvs. linear or oblong-lanceolate and narrowed into a petiole: bracts small, scarious: perianth-tube none; stamens 6, fixed at the base of the segms.; filaments erect, distinct, shorter than the linear anthers; cells of 3-celled ovary 2-ovuled: fr. indehiscent; seeds in the form of a globose berry.—The E. Indian species appear not to be cult. The genus is closely allied to *Liriope*. *O. spicatus* = *Liriope graminifolia*.

Of this genus, two species are well known in cultivation. They are low-growing herbaceous perennials from Japan, with linear foliage, which is often striped or spotted with white or yellow, and racemes of small six-parted pendulous flowers, varying from white through lilac to violet-purple. They are procurable from a few dealers in hardy perennials, from specialists in Japanese plants and from Dutch bulb-growers. The most popular form is *O. Jaburan* var. *aureus variegatus*, which is chiefly used as a greenhouse foliage plant. The flowers of *O. Jaburan* are followed by large showy shining dark blue berries. It is easy to manage in the window, and is almost hardy. *O. japonicus* is much used in Italy and southern France for a green turf and for border edgings, and it begins to be used for the same purpose in southern California. It needs no clipping, and will stand under the shade of trees, making a dark green lawn-cover, standing well in drought. The species of ophiopogon are propagated by division.

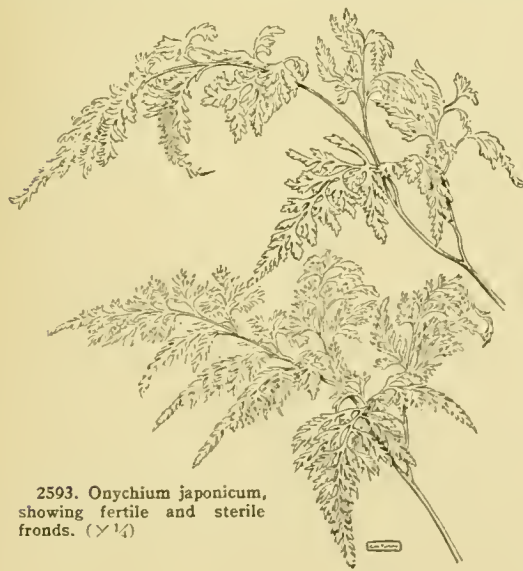
japonicus, Ker. Perennial stemless glabrous herb, with a stoloniferous rhizome: fibrous roots long, slender, often nodulose: root-lvs. numerous, erect, narrowly linear, $\frac{1}{2}$ -1 ft., and 1-1 $\frac{1}{2}$ lines wide, 5-7-nerved: scape 2-4 in. long; raceme lax, few-fl'd., 2-3 in. long, the lower fls. in groups of 2-3; fls. drooping, violet-purple to lilac or more or less whitish. Japan, Korea, N. China. B.M. 1063. Var. *variegatus*, Hort., has variegated foliage.

Jaburan, Lodd. Habit of the above, but more robust: lvs. 1 $\frac{1}{2}$ -3 ft. long, 4-6 lines wide, many-nerved: scape $\frac{1}{2}$ -2 ft. long; raceme 3-6 in. long, the lower fls. usually in groups of 6-9; fls. white to lilac. Japan. L.B.C. 19:1876 (a fine pure white). Var. *cæruleus*, Hort., has "blue" fls. Var. *aureus variegatus* has foliage striped golden yellow. Var. *argenteus variegatus* has foliage spotted white. Var. *argenteus vittatus* has foliage striped white.

Regnièri, Bois. Stemless: lvs. in a rosette, erect or reflexed, lanceolate, slender-petioled, to 1 ft. long, marked with pale green and yellow: scape 8 in., 2-edged, bearing a several-fl'd. raceme; fls. violet-white, to



2594. *Ophioglossum vulgatum*.—Adder's tongue.



2593. *Onychium japonicum*, showing fertile and sterile fronds. ($\times \frac{1}{4}$)

$\frac{3}{4}$ in. across, the tips of the segments greenish. Cochinchina. R.H. 1906, p. 371.—Recent.

WILHELM MILLER.
L. H. B.†

OPHRYS (Greek, *eyebrow*). *Orchidaceæ*. Terrestrial orchids.

Having the habit of *Goodyera*, bearing a basal rosette of lvs. with an erect fl.-st. terminating in a raceme or spike of fls.: sepals similar, spreading; petals smaller, often pubescent; labellum generally convex with incurved margins, not spurred, entire or 3-lobed; column short.—About 30 species, mostly in the North Temperate Zone in Eu., Asia and N. Afr., the greater number being found in the Medit. region. Cult. as for *habenaria*.

A. Margin of the labellum brown or purple-brown.

B. Labellum scarcely longer than the sepal.

C. Sepals green.

aranifera, Huds. SPIDER ORCHIS. Resembles *O. apifera*. Sepals green; petals very short; labellum dull brown, marked with paler spots, obscurely lobed. Spring and early summer. Eu. B.M. 5712. B.R. 1197.

fusca, Link. Lvs. oblong-lanceolate, those on the st. narrower; sepals green, ovate-oblong, the upper one smaller, oblong; petals half as long, lanceolate-obtuse; labellum oblong, dark purple and hairy on the margin, disk light blue, polished. Medit. region. B.R. 1071.

CC. Sepals rose-colored or white.

arachnites, Lam. St. erect, leafy: lvs. ovate-lanceolate; fls. distant; sepals ovate concave, rose-colored, tinged with green; petals conical, fleshy, smaller than the sepals and colored like them; labellum round, with the sides reflexed, black-purple, with yellow marks and green appendages. Cent. Eu. B.M. 2516. G.C. III. 48:482.

apifera, Huds. (*O. arachnites*, Reichenard). BEE ORCHIS. St. 9–18 in. high, with few oblong or lanceolate lvs.: fls. 3–6, rather large; sepals ovate, pale pink or white; petals smaller, erect; labellum broad, convex, lobes all turned, velvety brown, marked with paler lines or spots. Fls. early summer. Dry pastures, Cent. and S. Eu. Gn. 69, p. 257. G. 35:379.

BB. Labellum longer than the sepals.

Spéculum, Link. LOOKING-GLASS ORCHIS. St. 4–12 in. high, 3–6-fl.: lvs. linear-oblong; fls. $\frac{1}{2}$ –1 in. across; sepals linear-oblong, green, with purple bands; petals very small, triangular-lanceolate, dark purple-brown; labellum quadrate, oblong, very convex; disk shining blue, with a yellow edge; margin pilose and fimbriate, maroon-purple. Medit. region. B.M. 5844. B.R. 370.

muscifera, Huds. (*O. myodes*, Jacq.). FLY ORCHIS. St. very slender, 3–4-fl.: sepals oblong or narrowly ovate, greenish; petals narrowly linear; labellum long, oblong, purplish brown, with pale white or blue marks in the center; central lobe notched. Spring and early summer. Cent. and E. Eu. R.B. 21:241.

AA. Margin of the labellum yellow or greenish yellow.

tenthredinifera, Willd. SAWFLY ORCHIS. St. 6 in. high; lvs. elliptic-lanceolate; spike 3–8-fl.: fls. nearly 1 in. across; sepals oblong, obtuse, concave, varying from rose to white; petals very small; labellum broadly obcordate, greenish yellow, pubescent, with a large chestnut-colored spot on the disk. Medit. region. B.R. 205; 1093. B.M. 1930. F. 1872, p. 128.

lutea, Cav. St. 4–7 in. tall, many-fl.: lvs. linear-oblong; fls. $\frac{3}{4}$ in. across; sepals oblong, obtuse, incurved, green; petals much smaller, linear-oblong; labellum quadrate, golden yellow, with a purple disk. Medit. region. B.M. 5941.

Aceras anthropophora, Br. Advertised as *Ophrys anthropophora*, Linn. MAX ORCHIS. St. about 9 in. high, the spike

being 2–4 in. long; lvs. ovate to oblong or lanceolate; fls. dull yellowish green; sepals and petals converging over the column; labellum much longer than the sepals; side lobes long, narrow, and the middle lobe split into 2 narrow lobes. Early summer. Pastures, S. Eu. *Ophrys* differs from *Aceras* in having a very convex labellum. Both genera are distinguished from *Oreobis* by the absence of a spur.—*O. etrusca*, Hort., and *O. Grampinii*, Hort., are hybrids between *O. aranifera* and *O. tenthredinifera*.

The name *Ophrys* is used by some botanists to replace *Listera* (p. 1891); in that case, the synonymy of the *Listera* becomes: *O. convallarioides*, Wight (*Listera convallarioides*, Torr.),—*O. cordata*, Linn. (*Listera cordata*, R. Br.),—*O. Smollii*, House (*Listera Smollii*, Wiegand). Similar to *O. convallarioides*: lvs. ovate-reniform, borne at or below the middle of the st.; raceme loose, few-fl., lip $\frac{1}{4}$ in. long, not ciliate, broadly ovate, cleft at the apex; ovary glabrous. Mountains of Pa. to N. C.

HEINRICH HASSELBRING.

OPHTHALMOBLÁPTON (Greek, *eye injuring*, from its poisonous action). *Euphorbiaceæ*. Trees with milky juice: lvs. alternate, simple, pinnately veined; inf. axillary or lateral; fls. inconspicuous, monoecious, apetalous; calyx with 1–3 short lobes, valvate in the bud; stamen 1; styles connate to the apex; ovary 3-celled, 3-ovuled.—Three Brazilian species related to *Sapium* and *Stillingia*, not cult. but noted for their poisonous action upon the skin and mucous membrane. *O. macrophyllum*, Fr. Allem., SAINT LUCIA, is the best known species.

J. B. S. NORTON.



2595. *Oplismenus hirtellus*.

OPIUM is the product of *Papaver somniferum*, the common annual summer-blooming poppy of gardens with smooth, glaucous leaves and white flowers.

OPLÍSMENUS (Greek, *awned*, referring to the

awns). *Gramineæ*. Delicate creeping, branching grasses with rather broad blades and narrow panicles consisting of spreading 1-sided racemes: spikelet 1-fl.; first and second glume and often the sterile lemma awned.—A genus allied to *Panicum*, containing 5 or 6 species of the warmer regions, one of which is cult. in conservatories for ornament.

hirtellus, Roem. & Schult. (*Panicum variegatum* of florists). Fig. 2595. A half-creeping perennial, with small, greenish panicles, the common form with neatly white- and pink-striped lvs. W. Indies. Gn. 47, p. 68. G. 37:271.—Popular for edges of beds and for hanging-baskets. Prop. by divisions of the rooting sts. This plant has usually passed as *O. Burmannii*, which, however, is an annual with silky panicles.

A. S. HITCHCOCK.

OPORÁNTHUS: *Sternbergia*.

OPÚNTIA (old Latin name used by Pliny, later used for the Indian fig, probably derived from *Opus*, a town in Greece). *Cactaceæ*. Succulent plants, a few species of which are extensively cultivated in warm regions for their large, edible fruits, while others are grown as hedges; numbers of species are grown in the collections of fanciers for their oddity.

Opuntias vary from small, prostrate plants a few inches above the ground to trees with spreading tops 20 or more ft. high: sts. flat, clavate or cylindrical, bearing more or less elevated areoles, from each of

which appears a small caducous pointed lf., rarely spreading and foliar; an oval or circular area, more or less covered with soft wool, intermixed with barbed bristles and usually a variable number of spines, occurs in the axil of each lf.: fls. borne singly toward the upper part of the joints or sts., on the bristle-bearing part of the areole, and with spreading, showy corollas; the usually many-ovuled inferior ovaries are not of foliar development, and sometimes differ but slightly in appearance from normal sts., usually bristle- and spine-bearing; fr. dry or succulent, frequently edible; seeds large, flattened, discoid and often margined.—There are about 130 species and many varieties and hybrids, extending from Canada southward through the U. S., Mex., W. Indies and Cent. Amer. to the southern part of S. Amer. The species are confined mostly to arid and semi-arid regions; however, some are found in regions of heavy rainfall. They are found in greatest quantity and variety of species in S. W. U. S. and N. Mex., where they are often trees and form the most conspicuous part of the flora. *Opuntia* is a genus of great variation in habit and appearance, and, from the frequency of natural hybrids and ill-defined specific lines, one of the most difficult genera of flowering plants to present satisfactorily in systematic order. Some of the largest cacti are opuntias, while nearly all that are of economic value belong to this genus.

Although the opuntias are less attractive as pot-plants and, on account of their barbed spines and bristles, more difficult to handle than most other cacti, they are coming into favor on account of their unique appearance, rapidity of growth and attractive flowers. They grow best with an abundance of heat and sunlight, the character of the soil being a secondary consideration. Like all other cacti, they require perfect drainage. They are readily grown from cuttings, and also from seed under proper management.

Economically considered, the opuntias are by far the most important of the cacti. Although originally confined to the New World, the more important species are now in cultivation or have escaped from cultivation and become wild in every arid and semi-arid region of the globe where the temperature permits their being grown. Wherever grown, their tendency is to escape from cultivation and become persistent and troublesome weeds. In this respect they are much more to be dreaded in foreign countries than in America, the place of their nativity.

As ornamental plants, opuntias are unusual rather than pleasing. From their stiff, formal aspect they do not harmonize, as a rule, with other plants, and on account of their spines and bristles they are difficult to handle and are considered by most gardeners as a nuisance in decorative planting. It is as hedges and as groups of mixed species that they are most effective. Most species grow rapidly and bloom profusely. The flowers, as a rule, are large and showy and of various colors, although yellow predominates. They wither soon after opening and remain at their best only for a few days. The spines and bristles which usually cover the base of the flowers render them of no value as cut-flowers. With many species, such as *O. leptocaulis*, *O. tetra-cantha*, and some forms of *O. Tuna*, the bright-colored fruits, which remain on the plants for a long time after ripening, render them more attractive in fruit than in flower. Crested or fasciate forms (Fig. 2596) are common.

Although extensively cultivated for their fruit in many countries, where they furnish an important article of diet for four to five months each year, they do not as yet take a pomological rank with the horticulturist, although they are much more widely used and of far more economic importance than many plants which have an established place in pomological literature. From the fact that opuntias flourish best in regions where experimental horticulture receives little or no

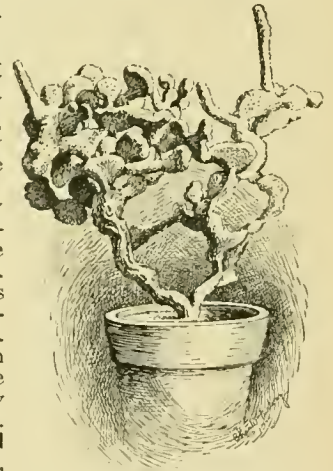
attention, the development of desirable economic varieties has not been what might be expected of plants which respond so readily to cultivation and selection, and which may be hybridized with so little difficulty. Botanically considered, the fruit is a kind of berry, varying from dry to fleshy and succulent. Morphologically, it is a modified stem with the true seed-capsule sunken into its apex; hence it bears leaves and spines, and usually, under suitable conditions, and frequently in the natural state when it becomes detached, will bud and grow like a normal stem-cutting.

Opuntias were cultivated by the aborigines of America at the time of its discovery, and were early taken by the Spanish explorers to Spain and Spanish colonies in other parts of the world. After becoming established in the Canaries, Azores, and Madeira islands, it was not long before their culture extended to Portugal, Spain, and the whole littoral region of the Mediterranean. From there they spread to Egypt, India, and other parts of southern Asia. In comparatively later times they reached South Africa, Australia, and New South Wales, where they are fast becoming a serious menace to agriculture and grazing. In all the regions above noted they have escaped from cultivation and have become pestiferous weeds.

The want of fixed characters, the great variations in most species under different soil and climatic conditions, and the readiness with which natural hybrids occur, make the identification of cultivated and introduced species so difficult that the considerable literature on this subject is extremely uncertain as to nomenclature. The common names Indian fig, barberry fig, prickly pear, and tuna, are applied indiscriminately by most persons to any flat-jointed opuntias, but more particularly to the kinds with edible fruits.

The two most widely distributed and extensively cultivated are *O. Ficus-indica* and *O. Tuna*. These plants have often been confused by authors. Much that has been written under the name of one species really applies to the other. They are closely linked together by hybrids, and each has been in cultivation for so long a period that numerous cultural varieties have developed, particularly in Mexico and Sicily. It is possible that the many cultivated forms of both species originated from the same source.

Although the Mexicans and Indians eat the fruit of more than a score of indigenous species, the two named above, with their many cultivated forms, are by far the most desirable and palatable. *O. Ficus-indica* is preferable in most respects to *O. Tuna* on account of its fewer and smaller spines and usually larger fruit. The latter, however, makes a more formidable hedge, and is more frequently planted in the United States. Hedges of this plant are to be seen at many of the old Spanish missions in Arizona and California, where they were probably first introduced into the United States. *O. Ficus-indica* is frequently grown by the Mexican population of New Mexico, Arizona, and California. In southern Florida it has escaped from cultivation and

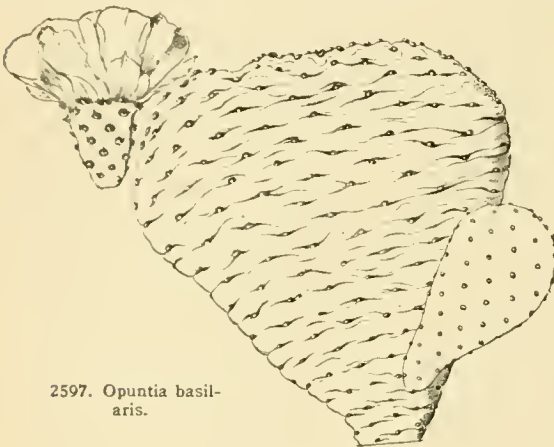


2596. *Opuntia ramosissima*. To illustrate fasciation, which is of frequent occurrence in nearly all species of cacti.

become naturalized. The fruits are usually larger and fewer-seeded than in *O. Tuna*, and are commonly yellow. They frequently measure 3 to 4 inches in length and 2 to 3 inches in width. Forms of this species about the old missions of southern California vary considerably. One form, known as *Tuna Colorado*, has an insipid, light crimson-colored fruit, while another, *Tuna manse*, has a yellowish fruit, irregularly mottled with crimson.

General cultivation. (D. M. Andrews.)

Hardy opuntias satisfy a rather general desire for something unique or grotesque, while at the same time they possess enough ornamental value to recommend them to everyone, and especially to those lovers of cactaceous and succulent plants whose space indoors is limited. Being natives of the western plains and foothills of the mountains, they can scarcely suffer from long-continued drought, and the sunny side of the rockery will suit them exactly, as it will allow all surplus moisture to drain off, and no artificial watering will be necessary. William Falconer, who has used large quantities at Schenley Park, Pittsburgh, Pennsylvania, writes as follows: "In certain localities, as on



2597. *Opuntia basilaris*.

bleak, exposed banks and about rocky knolls, opuntias and *Yucca angustifolia* can be used unsparingly with perfect success." He also says, "All have been planted out-of-doors, remaining unprotected summer and winter, and all have been perfectly hardy." They have succeeded also at Kew Gardens, in the very humid climate of England, without protection. Their requirements seem to be as follows: a porous, well-drained soil, a sunny exposure, and a season long enough in which to ripen the fruit and annual growth; these conditions being complied with, they will endure almost any degrees of cold to be experienced even in the most northern portions of the United States. Their altitude-limit in Colorado indicates that they will succeed as far north as Indian corn can be matured. The following kinds have been used successfully, as above indicated: *O. arenaria*, with small, round to oblong, very spiny joints, the spines varying much in color from gray and straw-color to purplish brown; *O. arborescens*, the tree or candelabrum cactus, the tallest of this list, is of cylindrical branching growth, with bright purple flowers and yellow fruit; *O. Camanchica* has very large, orbicular joints, the upper half thickly beset with spines, fruit purple; *O. fragilis* resembles *O. arenaria*, but is smaller; *O. humifusa* includes a multitude of forms, all of which are very hardy; *O. phaeacantha* var. *major* is one of the most striking sorts, with immense, glaucous joints, dark purple spines, yellow flowers, and purple fruit; *O. polyacantha* is one of the most variable, as well

as one of the most showy. The spines vary from ivory-white to purple and brown, and from short and stout to long and slender. Nearly all the opuntias have very showy flowers, usually in various shades of yellow and orange.

Economic value and cultivation.

Two opuntias, *O. Ficus-indica* and *O. Tuna*, and possibly a few other closely allied ones, are extensively grown in Mexico. The fruit begins to ripen in June and July, while the later varieties last until December. The fruit is consumed by all classes and conditions of people. The fine bristles which invest the fruit are usually removed before picking by rubbing them with straw, grass or leaves. The fruit is later picked by the hand, or, in some instances, with wooden tongs. In large plantations, when the fruit is raised for commercial purposes, it is usually harvested with a heavy knife, the workman first cutting off the joint bearing the fruit, and later detaching the separate fruits.

In preparing the fruit for the table, a thin slice is cut from each end and a slit made through the paring, joining the cut surfaces. The thin paring is easily separated from the mealy but juicy pulp, and quickly removed with the fingers.

Today the finest opuntia fruits are grown in Sicily, where they are one of the most important crops that the island produces. From July to November the peasants live almost entirely on this fruit, and considerable quantities are yearly exported to other countries, some of which finds its way to New York and other American cities. It is grown extensively by the Arabs throughout northern Africa, and forms an important part of their food for a portion of each year.

The nutritive value of this fruit ranks high, as shown by the following analysis by Wolff:

	Per cent
Dry substance.....	21.60
Ligneous matter.....	3.70
Proteid substances.....	.59
Fatty bodies.....	1.80
Sugar.....	14.00

It has been ascertained that some of the best varieties are capable of producing on lean, sandy or rocky soil, ill-suited for growing ordinary crops, as much as 18,000 pounds of fruit to the acre. When it is considered that this is equal to 2,500 pounds of sugar, as well as other valuable food constituents, it may be readily seen that the food value from the standpoint of nutrition is considerable.

Plantations are usually made on dry slopes of hills, as the plants do not thrive where there is much moisture or on heavy clay soils. Joints, cut or broken from the plants, are used instead of seeds, and are planted at distances of 6 to 8 feet in furrows from 6 to 15 feet apart. No tillage is practised, as they grow rapidly, and in a few years shade and smother out all other growth. Before planting, the cuttings are exposed in half sunlight from seven to fifteen days, that they may partially wither, in order to facilitate rooting.

An important advantage in the culture of these plants is the regularity of the yearly crop. They begin to bear in about three years after planting, and continue in bearing for many years.

Of the opuntias indigenous to the United States, none as yet has been grown for fruit, or with an effort to improve them. *O. Engelmannii* has a large but poorly flavored fruit, rarely eaten, even by the Indians. *O. levis* has one of the largest and most palatable fruits of any of the species found growing wild within the United States. This plant also has the advantage of having but few spines. *O. Camanchica*, *O. humifusa*, *O. chlorotica*, *O. phaeacantha* and *O. macrocentra* have medium-sized fruits, insipid and unpalatable to the cultivated taste, but eaten by Indians and Mexicans.

Wherever grown extensively, the opuntia fruits are used for making a weak alcoholic drink. The juices of

the highly colored sorts are sometimes used to color confectionery.

Many of the opuntias have considerable forage value, particularly during periods of long drought when other forage crops are short. The range cattle of the southwestern United States feed on either the branches or fruits, or both, of nearly all the indigenous species, the flat stems of *O. Engelmannii* and the pendulous fruit clusters of *O. fulgida* being most largely consumed. When cattle are fed largely on unsinged native opuntias, the spines and bristles do great injury. They collect mainly in the mouth, making eating very difficult if not impossible on this account. There are indications that "hairballs" composed of opuntia fibers and spicules are likely to be prevalent also under such conditions.

In northern Africa the flat joints of the forms with few spines are used as forage for cattle during the dry season, after being allowed to ferment slightly. In Tunis, plantations are sustained by dairymen for the purpose of feeding their cows upon the fleshy stems.

Species of opuntia have run wild to a remarkable extent in southern Africa. They have spread rapidly during the past century, and in many places have crowded out the grasses and become a nuisance. Two forms of the plant are recognized by the Dutch farmers; viz., a thorny variety growing on the open country and on stony hill-sides known as Doornblad, and a fewer-spined larger variety with thicker stems known as Kaalblad. It is probable that these two varieties originated from the same introduction, for, according to Macdonald, the seed from the Doornblad or Kaalblad variety may give rise to plants resembling either or both of them. It is extensively used as feed for cattle, ostriches and pigs, either alone or when mixed with other forage. Here, however, much harm has come from range cattle eating it in times of little or no other forage, and ostriches become blind from the spines and bristles getting into their eyes in eating the fruits.

In New South Wales and Anstralia, where several species have escaped from cultivation and spread over large areas of arable land and driven out more valuable forage plants, the land has depreciated 50 per cent in value. Here, however, some of the worthless species, such as *O. vulgaris* and *O. monacantha*, are more widely spread than the more valuable varieties of *O. Ficus-indica* and *O. Tuna*.

From what has been said it may be seen, first, that varieties of *O. Ficus-indica* and *O. Tuna* produce large crops of edible and nutritious fruits; second, that plants with few or no spines are the general rule in *O. Ficus-indica* and of not infrequent occurrence in *O. Tuna*; third, that opuntias are strong, vigorous plants that will grow in situations in which few other plants will thrive; fourth, that spineless forms make valuable forage.

With these and more qualities to recommend them, it yet remains for horticultural enterprise to develop a spineless and bristleless variety that will not only be of value for forage but will produce large crops of fruits as attractive to the educated palate as to the savage. From the experience gained in establishing a garden of nearly seventy species and varieties of opuntias, comprising about 300 plants, and watching their growth and behavior for several years, it is thought that they offer great possibilities in the way of improvement in the hands of a careful plant-breeder.

In recent years, the prickly pear has attracted considerable attention as forage for cattle. Full report of yields of several species in test plantations in southern Texas is given in Bulletin No. 208 of the United States Department of Agriculture (May, 1915) by David Griffiths. See also a discussion of the forage value of prickly pears by Woodward, Turner and Griffiths, "Journal of Agricultural Research," August, 1915.

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KEY TO THE SPECIES.

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|--|---|
| A. Articulations or joints strikingly different, flat to cylindrical..... | 1. brasiliensis |
| AA. Articulations or joints similar, more or less flattened (Nos. 2-32). | |
| B. Species from S. Amer..... | 2. galapageia
3. monacantha
4. aurantiaca
5. crinifera |
| BB. Species from N. Amer. | |
| C. Joints pubescent..... | 6. microdasys
7. basilaris
8. puberula |
| CC. Joints not pubescent (except sometimes in <i>O. pycnantha</i>). | |
| D. Fr. fleshy or succulent. | |
| E. Size of joints large: plants mostly large (<i>O. crassa</i> moderately small). | |
| F. Color of spines white..... | 9. leucotricha
10. triacantha
11. candelabri-
[formis] |
| FF. Color of spines yellow (sometimes red to white in <i>O. Engelmannii</i> , <i>O. polyantha</i> , <i>O. crassa</i> , and <i>O. Ficus-indica</i>). | |
| G. Spines none or few.... | 12. crassa
13. Ficus-indica |
| GG. Spines always present, few to many. (One form of <i>O. macrocentra</i> has no spines, and occasional plants of <i>O. chlorotica</i> are without spines.).... | 14. polyantha
15. Tuna
16. chlorotica
17. pycnantha
18. Engelmannii |
| FFF. Color of spines reddish brown to black, usually with purplish joints.... | 19. phaecantha
20. Camanchica
21. macrocentra
22. nigricans |
| EE. Size of joints small: joints variable in shape: plants mostly low or prostrate. (Some forms of <i>O. humifusa</i> have moderately large joints.)..... | 23. filipendula
24. humifusa
25. vulgaris
26. Pes-cervi |

- DD. *Fr. dry, more or less spiny*.. 27. *ursina*
 28. *hystrix*
 29. *polyacantha*
 30. *rutila*
 31. *arenaria*
 32. *fragilis*
- AAA. *Articulations or joints similar, more or less cylindrical.*
 B. *Species from S. Amer.*
 C. *Joints cylindrical, mostly elongated*..... 33. *cylindrica*
 34. *vestita*
 35. *clavarioides*
 36. *Salmiana*
 37. *Darwinii*
 38. *diademata*
- CC. *Joints globose to broadly obovate*... 39. *pulchella*
 40. *clavata*
 41. *Grahamii*
 42. *Schottii*
 43. *Emoryi*
 44. *invicta*
- BB. *Species from N. Amer.*
 C. *Spines without sheaths: plants mostly small, with clavate joints*..... 45. *Davisii*
 46. *acanthocarpa*
 47. *echinocarpa*
 48. *Bernardina*
 49. *serpentina*
 50. *prolifera*
 51. *fulgida*
- EE. *Fr. fleshy, prolific*..... 52. *Bigelovii*
 53. *imbricata*
 54. *arborescens*
 55. *spiniosior*
 56. *Whipplei*
 57. *versicolor*
 58. *tetracantha*
- DD. *Number of spines few, usually one, rarely more or wanting*.. 59. *arbuscula*
 60. *leptocaulis*
 61. *ramosissima*

1. *brasilensis*, Haw. A large, tree-like plant reaching a height of 15-18 ft., numerously branched, with a thick, roundish crown and an upright trunk, 4-6 in. diam., and bearing numerous spines 1 in. or less in length: joints of two kinds, cylindrical, unarticulate, elongate ones and others which are shorter and much flattened and which arise as offshoots from the former; the latter lf.-like, thin, 2-6 in. long, oblong, rarely oblong-lanceolate or orbicular, dark green, margin angular, sometimes irregular: areoles with short gray wool and numerous brown bristles; spines usually 1, sometimes 1-3 small additional ones, 1-2½ in. long, mostly from the marginal areoles, white, with brownish tips: fls. numerous, citron-yellow, 2 in. wide: fr. globose or ellipsoidal, yellow, about 1½ in. diam. Brazil and southward.—One of the species most frequent in cult.

2. *galapagëia*, Hensl. An upright, tree-like plant 6-10 ft. high, with a circular, spreading crown and a very spiny trunk, 6-8 in. diam., and light-colored bark becoming loose and hanging in fragments from the older sts.: joints elliptical to oblong, thick, 10-14 in. long: spines at first 3-4, spreading, flexible, increasing in number and size with age, finally covering the

joints with long, brush-like bundles: fls. small, less than 1 in. wide, red: fr. subglobose, red. Galapagos Isls.

3. *monacantha*, Haw. An upright plant branching from the ground and reaching a height of 6 or more ft.: joints oblong to elliptical, rather thick, terminal ones much thinner, 5-12 in. long, 3-6 in. wide, bright green: areoles with uniformly short wool and yellowish brown bristles; spines 1-2, seldom more, erect, ¼-1½ in. long, yellow to dark reddish brown: fls. yellow, 3 in. wide: fr. ellipsoidal to pyriform, occasionally proliferous, red, somewhat spiny. Argentina.—The horticultural variety, *variegata*, is in the trade.

4. *aurantiaca*, Lindl. A numerously branched, rather weak, semi-prostrate plant 3-5 ft. high: joints linear-lanceolate to lanceolate, 2-10 in. long, ½-1 in. wide, elliptical in transverse section, dark green, turgid: areoles with a tuft of grayish white wool and bright yellow bristles; spines 4-6, spreading, straight, stiff, brown to yellow, the longest less than 1 in. long: fls. yellow, 1½-2 in. wide: fr. carmine-red, globose, with short spines; seed with woolly hairs. Argentina.

5. *crinifera*, Salm-Dyck (*O. senilis*, Parm.). A much-branched, wide-spreading plant, about 3 ft. high: joints obovate to elliptical, 6 in. long and 3-4 in. wide, dark green, occasionally glossy: areoles crowded, small, with white wool, numerous golden yellow bristles, and a variable number of long silky hairs; spines 6-8, later more, white, glistening, reaching 1 in. long, the long silky hairs particularly developed on the under side of the young joints: fls. 3½-4 in. wide, golden yellow, often reddish. Brazil(?).

6. *microdasy*, Lehm. An erect, wide-spreading plant, rarely more than 3 ft. high: joints elliptical to obovate, 3-4 in. long and nearly as wide, thick, bright green, densely pubescent: areoles with short, whitish wool and numerous golden yellow bristles of variable lengths; spines wanting: fls. greenish to lemon-yellow, about 2 in. wide: fr. comparatively small, oval, less than 1 in. diam., armed with numerous yellow bristles; flesh whitish. N. Mex., southward.

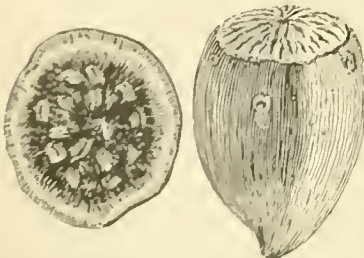
Var. *rufida*, K. Schumann. Of more robust growth: joints rounder and larger, paler green, the bristles inclined to reddish brown. Mex.

7. *basilaris*, Engelm. & Bigel. Fig. 2597 (adapted from Pacific R. R. Report). A low, spreading plant, rarely 1 ft. high: joints thick, variable, usually broadly obovate, with more or less truncate top and branching from the base, 4-7 in. long and 2-4 in. wide, bluish green, and very minutely pubescent: areoles depressed, close together, and with brownish yellow wool and numerous short yellowish brown bristles; spines wanting, rarely present: fls. dark purple, rarely white, 3 in. or more diam.: fr. short, thick green, becoming white and dry at maturity and filled with many large white seeds. S. W. U. S. and N. Mex.

Var. *ramosa*, Parish. A smaller plant, with joints branching from the upper end, and usually glabrous. S. Calif.

Var. *Trelëasii*, Coult. Differs from the species in having larger orbicular or obovate joints, with terete base, and larger lvs. S. Calif.

8. *puberula*, Pfeiff. A numerously branched and upright plant, 2-3 ft. high: joints obovate or somewhat rounder, when young covered with very soft pubescence which becomes bright green with age: areoles with short brownish yellow wool and numerous short amber-colored bristles; spines 5-7, 1 in. or more in length, straight, cylindrical, white, with amber-colored base, shining, the lower ones the longer: fls. 1½-2 in. wide, greenish yellow; fr. oval, 1½ in. diam., the many areoles bearing short wool and many bright amber-colored bristles; flesh sweetish; seeds many, correspondingly small. Mex.



2598. Fruit of *Opuntia Ficus-indica*. (× ½)

9. *leucótricha*, DC. (*O. fulvispina*, Salm-Dyck). An upright, numerous branched plant, sometimes reaching the height of 10 ft.: joints elliptical or narrower, mostly rounded at the end, 8-10 in. long and half as wide, dark green: areoles small, with white or whitish gray wool and numerous short brown bristles; spines very slender, mostly 4 at first, but later as many as

slender, golden yellow, seldom over $\frac{3}{4}$ in. long: fls. $2\frac{1}{2}$ in. wide: fr. broadly oval, deep red. W. Indies(?). For. var. *albispina* consult *O. polyacantha*, No. 29, of which it is perhaps a form.

15. *Tùna*, Mill. (*O. hórrida*, Salm-Dyck). Fig. 2599. An erect, wide-spreading, tree-like plant, rapid-growing and frequently 10-12 ft. high: joints deep green, mostly elliptical, 10-14 in. long and 6-10 in. wide: areoles with whitish wool which later becomes dirty gray, and a fascicle of long brownish yellow bristles; spines 4-6, rigid, stout, yellow, frequently subulate, spreading, unequal in length, 1-2 in. long: fls. 3-4 in. wide, yellow, fading to red: fr. pear-shaped or rounder, 1-1½ in. diam., sweet, edible, dark reddish purple. W. Indies and Mex.—Probably the most extensively cult. of all the opuntias. Under the name of "tuna" it has been grown in S. W. U. S., W. Indies and Mex. since the earliest Spanish possession. It is extensively grown both for its fr. and as a hedge plant. It has escaped from cult. and become naturalized in N. and S. Afr., S. Eu., S. W. Asia and Austral., and in some places has become a troublesome weed.

16. *chlorótica*, Engelm. Fig. 2600 (adapted from Pacific R. R. Report). A compact, upright, moderately branched plant, from 3-6 ft. high, the trunk and main sts. becoming woody and terete, and densely covered with long straw-colored bristles and spines: joints orbicular, somewhat glaucous, 6-10 in. diam.: areoles crowded, with fine, gray wool and very numerous golden yellow bristles of unequal length; spines 3-6, rarely none, on old sts. occasionally 40 or more, unequal angular, golden yellow, deflexed, usually 1 in. or less long: fls. yellow, 2-3 in. diam.: fr. deep purple, moderately bristly, edible, 1½ in. diam., broadly obovate to globose; seeds comparatively small, sometimes sterile. S. W. U. S.

17. *pycnántha*, Engelm. An upright, moderately branched plant, 3-5 ft. high: joints oval to orbicular, occasionally somewhat pointed at the ends, 4-8 in. long, sometimes pubescent, armed with a densely interwoven covering of mostly deflexed spines: areoles crowded, approximately ½ in. apart, with dark brown wool and numerous long, yellow bristles; spines 3-7, on old sts. 20 or more, straw-colored to ashy, mostly less than 1 in. long: fls. greenish yellow, 2-3 in. broad: fr. obovate, 1½ in. diam., and covered with numerous spines and bristles. Low. Calif.



2599. *Opuntia tuna*.

10-12; some reach the length of 3-4 in., becoming bristle-like and very flexible: fls. 2-3 in. wide, yellow, with reddish center: fr. spherical, 1-1½ in. diam., pale green to white, thickly beset with velvety wool and brownish yellow bristles; pulp sweet, edible. Mex.

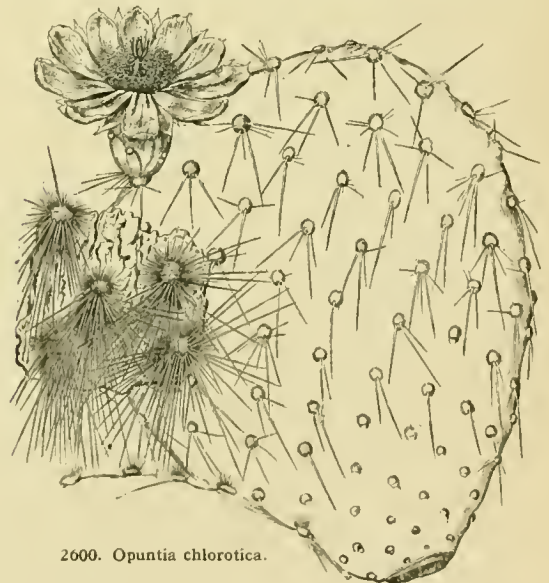
10. *triacantha*, Sweet. An upright, tree-like plant, reaching 10-12 ft. in height: joints often very large, occasionally 18 in. long and 10 in. wide, obovate, thick, grayish green: areoles remote, from 1¼-1½ in. apart, with short grayish wool and yellow bristles; spines 3-4, white, with yellow points and bases, 1 in. or less long: fls. 2½-3 in. wide, carmine to orange-yellow: fr. elliptical, 1½-2 in. long; pulp acid. W. Indies.

11. *candelabriformis*, Mart. An upright, sparingly branched plant, 2-4 ft. high: joints elliptical to obovate, thick, dark green, 6-10 in. long and half as wide: areoles with brownish white wool, later becoming gray, and numerous white bristles; spines 4-5, of which 3 are very strong, white, 1¼ in. or less in length: fls. 2½-3 in. wide, carmine-red: fr. spiny. Mex.

12. *crássa*, Haw. (*O. glauca*, Hort.). A sparingly branched, upright plant, 4-6 ft. high: joints oblong to ovate, 3½-5 in. long and two-thirds as wide, glaucous, greenish blue, thick: areoles with brownish wool, and few bristles of same color; spines usually wanting, sometimes ½ in. or less long, straight and needle-like. Mex.

13. *Ficus-indica*, Mill. (*O. gymnocarpa*, A. Web.). INDIAN FIG. Fig. 2598. An erect, tree-like plant, reaching the height of 10-15 ft., and with a woody cylindrical trunk: joints elliptical or oblong, often with bluish bloom, thick, often 18 in. long and one-third as wide: areoles orbicular and sparingly covered with white wool and yellow bristles; spines usually wanting, occasionally 1-2 small weak ones are present: fls. yellow, expanding to 3-4 in. diam.: fr. yellow, with reddish pulp, bristly, 2 in. diam., edible. Mex. J.H. III. 68:447.—A species widely grown throughout the warm temperate regions of the world. In some regions, escaping from cult., it has become a troublesome weed. Frequently cult. for its fr. under the name of Indian fig.

14. *polyántha*, Haw. A much-branched, spreading plant, 3 ft. or less in height: joints oblong to obovate, dark green, weak-spined, 4-6 in. long and 3-4 in. wide: areoles with white wool and brown bristles; spines 3-8,



2600. *Opuntia chlorotica*.

18. *Engelmannii*, Salm-Dyck. Fig. 2601. An erect to semi-prostrate, profusely branching, coarse plant, 2-5 ft. high, forming large, impenetrable thickets, usually with a short, more or less terete, woody trunk, with grayish bark which becomes unarmored with age: joints broadly obovate to orbicular, pale to bluish green, very

variable in size, in large specimens 12-14 in. long and nearly as wide, moderately thick: areoles remote, about 1 in. apart, with gray wool and large, rigid, gray to yellow, unequal bristles: spines mostly 2-4, sometimes 1-3 small additional ones, very variable, horny, variously colored, mostly yellow, or white with reddish base, usually compressed or angular and curved or twisted: fls. yellow,

spines: fls. 3 in. wide, yellow: fr. oval to globose, rarely ovate, 1 in. diam., red; pulp sweet, edible. S. W. U. S., Mex.—This species is remarkable for its exceedingly long, dark spines and purple joints.

22. *nigricans*, Haw. A large, robust, upright plant, 2-5 ft. high: joints usually obovate, dark green, rarely tinged with purple, about 10 in. long and 6 in. wide, moderately thick: areoles with short, grayish wool and yellowish brown bristles; spines 1-2, awl-shaped, 1-2 in. long, strong, dark brown, at first yellowish: fls. $1\frac{1}{2}$ -2 in. wide, yellow with red center. Mex.—Frequent in cult.

23. *filipéndula*, Engelm. A small, semi-prostrate plant, freely branching from the base of the joints, rarely 10 in. high and with thick, tuberous, moniliform roots: joints small and thin, bluish, glaucous, rarely 3 in. greatest diam., orbicular to broadly obovate, sometimes diamond-shaped, frequently flattened at the top and broader than long: areoles orbicular and with an abundance of whitish wool and many long, slender, yellowish green bristles, which are very conspicuous, particularly on the older joints; spines sometimes wanting, when present usually 1-3, rarely more, white, very slender and flexible, 1-2 in. long, mostly marginal: fls. yellow, $1\frac{1}{2}$ -2 in. diam.: fr. clavate to narrowly obovate, $1\frac{1}{2}$ in. long and half as wide, greenish yellow, with few seeds. Texas to Ariz., extending into Mex.

24. *humifusa*, Raf. (*O. Rafinesquii*, Engelm. *O. mesacantha*, Raf.). Fig. 2602 (adapted from Pacific R. R. Report). A wide-spreading, prostrate plant, freely rooting from the lower margin of the joints, roots sometimes tuberous: joints obovate to orbicular, usually 2-5 in. long and 2-4 in. wide, sometimes twice as large, dark to light green: areoles with gray wool and bright reddish brown bristles; spines sometimes wanting, when present 1-3 and mostly marginal, stout, 1 in. long, white with darker tips and bases, frequently 1-3 small secondary spines also present: fls. 3 in. or less diam., golden yellow, frequently with reddish center: fr. slender-clavate or broader, $1\frac{1}{2}$ -2 in. long, yellowish red

2601. *Opuntia Engelmannii*. (X $\frac{1}{2}$)

low, red within, fading to red, $2\frac{1}{2}$ -3 in. diam.: fr. broadly pyriform to globose, frequently 2 in. diam., dark purple, with insipid purple flesh. U. S. and Mex.—This species, with its numerous varieties, is the most widely distributed and abundant of the large, flat-stemmed opuntias in the U. S. It varies greatly in different localities, and its many forms have not as yet been adequately defined.

19. *phæacantha*, Engelm. A diffuse, semi-prostrate plant, 1-2 ft. high, and freely rooting from lower margin of joints: joints broadly obovate, moderately thick, 4-6 in. long: areoles about 1 in. apart, with short wool and reddish or brownish bristles; spines mostly toward margin or on apex of joints, 2-5, straight and stiff, reddish brown to almost black with lighter tips, $1\frac{1}{2}$ -2 in. long: fls. $2\frac{1}{2}$ in. broad, yellow: fr. usually long-pyriform, 1 in. or less diam. and twice as long, purple, with greenish acid pulp. S. W. U. S. and Mex. Var. *majior*, Hort., is a good form.—This species and a number of the following become deep purplish green during autumn and winter. In the spring they lose their purplish color to a large extent and take it on again in the fall. The spines are also much darker in winter than in summer.

20. *Camánchica*, Engelm. & Bigel. A prostrate, widely spreading plant 1-2 $\frac{1}{2}$ ft. high, and freely rooting at the lower margin of the joints: joints broadly obovate to orbicular, 4-6 in. long, moderately thick: areoles about 1 in. apart, with light brown short wool and yellowish brown bristles, mostly armed; spines very variable, usually 1-3, sometimes 3-6, on marginal areoles, reddish to blackish brown with lighter tips, variable in length, sometimes $2\frac{1}{2}$ in. long: fls. $2\frac{1}{2}$ -3 in. wide, yellow, with reddish center: fr. oval to globose, sometimes pyriform, deep red, sweet, edible, 1-1 $\frac{1}{2}$ in. diam. S. W. U. S. Var. *gigantæa*, Hort., of the trade proves to be *O. phæacantha*.

21. *macrocénta*, Engelm. A semi-prostrate, spreading plant, 2-3 ft. high: joints strikingly purple-green, very thin, broadly obovate to nearly orbicular, 5-9 in. diam., with a few remarkably long spines on the marginal areoles: areoles about 1 in. apart, grayish wool and short grayish yellow bristles; spines rarely wanting, usually 1-2, reddish brown to almost black, annulate, 3-5 in. long, slender and straight or variously twisted, sometimes 1-3 much smaller, lighter colored, secondary



2602. *Opuntia humifusa*.

to purple, with insipid purplish pulp; seeds comparatively large. W. Cent. U. S.—An exceedingly variable species of wide distribution and imperfectly known. Many varieties have been described, some of which are in the trade. The extreme forms vary greatly from the type. Of these forms vars. *Greëni*, *oplocarpa*, *cymochila*, *stenochila* and *macrorrhiza*, Hort., have appeared in the trade.



2603. *Opuntia ursina*.

narrowly ovate to obovate or oblong, 2–4 in. long and less than half as wide, frequently much smaller, very thick, broadly oval in transverse section, bright green with a bluish tinge; areoles circular, with short, whitish wool and a few short, slender, pale bristles; spines rarely exceeding 2, frequently none, slender, white, often brownish, less than 1 in. long; fls. yellow, 1½ in. wide; fr. obovate, bristly, purplish, 1 in. or less diam.; seeds comparatively large, very few. Fla.

27. *ursina*, Web. GRIZZLY-BEAR OPUNTIA. Fig. 2603. An upright, diffuse plant, 1–2 ft. high: joints oblong to obovate, grayish green, thick, 3–6 in. long and 2–4 in. wide; areoles with white wool and numerous yellow bristles; spines 12–20, reddish white, very slender and bristle-like, sometimes 4 in. long, frequently almost completely hiding the epidermis of the plant: fls. 2½–3 in. wide, reddish yellow. Calif.

28. *hystricina*, Engelm. & Bigel. A semi-prostrate, spreading plant, ½–1½ ft. high: joints obovate to orbicular, 3–5 in. long, moderately thick and very spiny; areoles with grayish wool and yellowish red bristles; spines 10–15, 2 in. long or shorter, white or dusky, slender, flexile, angular and twisted: fls. light purple, 2–3 in. wide; fr. broadly obovate, 1 in. diam., armed with many long spines. S. W. U. S.

29. *polyacantha*, Haw. (*O. missouriensis*, DC. *O. ferax*, Haw. *O. splendens*, Hort.). Fig. 2604 (adapted from Pacific R. R. Report). A prostrate, wide-spreading plant, rarely rising 1 ft. above the ground: joints variable, from elongate-obovate to orbicular, usually bright green, frequently wrinkled and tuberculate, 2–6 in. long; areoles about ½ in. apart, with short, grayish wool and long, reddish brown bristles; spines 0–12, very variable in length, number and color on different forms and plants from different localities, mostly marginal, white or variously tinged with red or brown, slender, twisted and flattened, some reaching a length of 3 in.: fls. yellow, darker within, 2–2½ in. wide; fr. broadly ovate or subglobose, ¾–1 in. diam., armed with numerous rather short spines; seeds comparatively large. W. Cent. U. S.—A species of wide distribution and very variable, some high mountain forms entirely without spines, while other forms are armed with a

close network of closely interwoven ones. A number of the forms have been segregated as varieties, of which the best known are *rufispina*, *platycarpa*, *microsperma*, *albispina* and *trichophora*, Hort. All the forms appear to run together and the varietal distinctions are of doubtful value. Hardy in Mass.

30. *rutila*, Nutt. A low, diffuse plant, ½–1 ft. high: joints tumid, readily becoming detached, and covered with a close network of slender, interwoven, light gray spines, thick, elongate-ovate, 2–4 in. long; areoles crowded, less than ½ in. apart, with short, white wool and yellow bristles; spines 3–5, sometimes a few short accessory ones, slender, reddish gray to white, with darker tips, 1¾ in. or less in length, larger ones often flattened and twisted: fls. red, 1½–2 in. wide; fr. broadly ovate to subglobose, usually armed with very long, interwoven spines; seeds comparatively large. S. W. U. S.

31. *arenaria*, Engelm. A diffuse plant with upright terminal joints, rarely 1 ft. high: joints thick, obovate, 2–5 in. long and half as wide, tumid, strongly tuberculate; areoles crowded, ¼–½ in. apart, with sparse white wool and numerous yellowish brown bristles; spines very variable in number and size, 3–10, slender, flexible, white to ashy gray, usually 1 in. or less long; fls. yellow, 2–2½ in. broad; fr. ovate to globose, very spiny; seeds large and irregular. S. U. S.

32. *fragilis*, Haw. A small, prostrate plant, rarely more than 4 in. high: joints tumid, fragile, easily detached, oval, elliptical, or subglobose, 1–2 in. long and nearly as thick as broad, bright green: areoles ¼–½ in. apart, with whitish wool and a few white to yellow bristles, which are much longer and more abundant on older joints; spines 1–4, occasionally a few small additional ones, weak, dark brown, the upper one usually longer and stronger than the others, rarely an inch in length: fls. greenish yellow, 1–1¼ in. wide; fr. ovate to subglobose, with few spines or bristles, mostly sterile, an inch or less long; seeds few and large. Rocky Mt. region from Canada to New Mex. Var. *brachyarthra*, Coult. A plant with more swollen joints, more numerous and stronger spines, smaller fls. and more spiny fr. Colo., New Mex. Var. *cæspitosa*, Hort. Joints bright green, smaller and more crowded than in the type; fls. bright yellow. Colo. Var. *tuberiformis*, Hort. Joints olive-green, bulbous-looking. Colo.

33. *cylindrica*, DC. (*Cereus cylindricus*, Haw.). A moderately branched upright plant, 10–12 ft. high, with main sts. 2–2½ in. diam., new growth dark green, the comparatively long (½ in.) lvs. persisting for some time; areoles depressed, with a little white wool, a few white bristles and some long white hairs; spines at first 2–3, erect, rather stiff, ½ in. or less long, at first whitish yellow, later grayish: fls. rose-red, 2–2½ in. wide from end of joints; fr. pyriform, 2–2½ in. long, yellowish green, somewhat spiny. Chile. Var. *cristata* is offered in cult.



2604. *Opuntia polyacantha*.

34. *vestita*, Salm-Dyck. A small, upright, numerous branched, ramifying plant a foot or more in height; joints rather short, 1-2 in. long and half as thick, usually dark green; areoles with white to grayish wool and a number of long, rather soft, grayish white hairs; spines 4-8, either short, flexible and grayish yellow or four times as long ($1\frac{1}{2}$ -3 in.), stiff and red; fls. 1-1½ in. wide, mostly lateral, dark red; fr. ellipsoidal, $1\frac{1}{4}$ -3 in. long, bright red and covered with grayish wool. Bolivia.

35. *clavarioides*, Link. & Otto. A low, numerous branched, spreading plant, 1-1½ ft. high; joints rather fragile and slender, ½ in. thick, cylindrical or somewhat clavate, frequently cristate, with numerous terminal, slender branches; lvs. extremely small; areoles close together, small, with white wool; spines 4-10, sometimes fewer, very small and appressed, white; fls. 1-1½ in. wide and twice as long, greenish red; fr. elliptical, $1\frac{1}{2}$ -3 in. long; seeds with woolly hairs. Chile. Var. *cristata* is offered.

36. *Salmiāna*, Parm. A numerous branched, upright plant, about 3 ft. high, with very long, proportionately slender branches; sts. about ¾ in. diam., with rough, fissured or cracked, grayish brown or lead-colored bark, the terminal joints pencil-like, 3-10 in. long and 1½-1 in. wide; areoles on young growth with sparse white wool and few bristles, on older growth the bristles are very numerous and somewhat spine-like; spines 3-5, spreading, about 1 in. long, grayish; fls. 1 in. wide, red; fr. pyriform, 1-1½ in. long, scarlet-proliferous, rarely fertile. Brazil.

37. *Dārwinii*, Hensl. A small, numerous jointed, prostrate, ramifying plant a few inches high; joints globose to broadly obovate, 1½ in. greatest diam., olive-green; areoles with yellowish wool and few bristles; spines rigid, 1½-2 in. long, the lower ones shorter and darker; fls. only on top of terminal joints, 1-1½ in. wide, yellow; ovaries as large as the joints. S. S. Amer.

38. *diademāta*, Lem. (*O. papyracantha*, Phil.). A low, moderately branched, spreading plant, rarely more than 4 in. high and forming dense patches several feet diam.; joints 1-1½ in. long and nearly as thick, globose to broadly clavate, usually growing several in succession, one above the other, young growth bright green, soon becoming grayish; areoles with abundant white wool and brownish black bristles; spines 1-2, papery, flexible, white or brownish with darker tips, ½ (?) in. long, and half as wide; fls. rather small, pale yellow. Argentina. R.B. 40, p. 186.

39. *pulchella*, Engelm. A small, spreading, numerous branched plant, seldom more than 6 in. high; joints ascending, 2½ in. long and ½ in. thick, obovate to clavate; areoles crowded, with white wool, and yellowish bristles which become more numerous and larger with age; spines 10-15, of variable length, the central one flattened, flexible, somewhat papery, 1 in. long; fls. from the top of the joints, purplish to rose-red, 1-1½ in. wide; fr. broadly clavate, 1 in. long, with long, hair-like, flexible white spines, dry. Nev., Ariz.

40. *clavata*, Engelm. Fig. 2605 (adapted from Pacific

R. R. Report). A low, spreading plant, 4-6 in. high, forming dense mats of ascending joints 4-5 ft. diam.; joints 1-3 in. long and 1 in. thick, armed with numerous short, flat spines; areoles with white wool and rigid, white bristles; exterior spines 6-14, white, $1\frac{1}{6}$ -¾ in. long, interior 4-7, larger, flattened, scabrous and $1\frac{1}{2}$ -1¼ in. long, one of the central spines usually very broad; fls. yellow, 1½ in. wide; fr. long-clavate, yellowish, dry, 1¼-1½ in. long, armed with many white radiating bristles. Nev., New Mex.

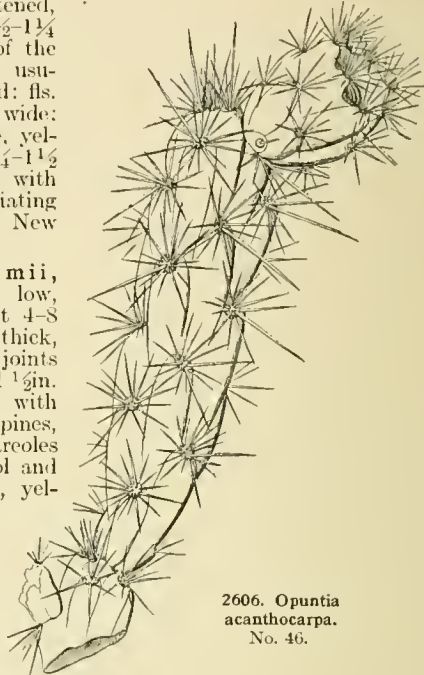
41. *Grāhamii*, Engelm. A low, spreading plant 4-8 in. high, with thick, fusiform roots; joints 2-3 in. long and 1½ in. thick, armed with long, dark spines, bright green; areoles with white wool and numerous long, yellowish brown, rigid bristles which become very conspicuous on old joints; exterior spines 4-8, ½ in. long, interior 4-7, more rigid and longer (1½-2 in.), reddish to ashy brown; fls. yellow, 1½-2 in. wide; fr. ellipsoidal, 1½-1¾ in. long and half as wide, armed with many large, radiating spine-like bristles. New Mex., Texas.

42. *Schöttii*, Engelm. A wide-spreading, prostrate plant, 4-6 in. high, with numerous short, curved branches; joints short-clavate, rarely more than 2 in. long and armed with numerous dark-colored spines; areoles with white wool and very few bristles; exterior spines 6-10, very variable, ½ in. long; interior usually 4, flattened or irregular, 1½-2 in. long, brownish red; fls. greenish yellow to reddish, 1½ in. wide; fr. short-clavate, the numerous areoles covered with white wool and many short bristles. Texas, Mex.

43. *Emoryi*, Engelm. A prostrate and spreading plant with comparatively large, long-clavate, curved joints and reaching a height of 8-12 in.; joints 4-7 in. long and 1-1½ in. thick, with large, elongated tubercles; areoles remote, with white wool and a few long (½ in.) yellow bristles; spines numerous, exterior 10-20, ½ in. or less long, very bulbous at base; interior 5-10, brownish to reddish black, more or less flattened and sometimes 3 in. long; fls. yellow, reddish within, 1½-2 in. wide; fr. ellipsoidal, yellow, 2-2½ in. long and 1 in. wide, armed with numerous bristles and spines. S. W. U. S., N. Mex.

44. *invicta*, Brandegee. A numerous branched, spreading plant, 10-14 in. high, bluish green and armed with many rigid, erect spines; joints 4-6 in. long and 2-2½ in. thick, nearly cylindrical; areoles with whitish wool and yellowish red bristles; spines 15-25, exterior 6-12, ½ in. or less long; interior 10-15, very strong and rigid, 1-2 in. long, more or less flattened; fls. yellow, 1½-2 in. wide; fr. broadly obovate, dry, armed with numerous reddish spines and bristles. Low. Calif.

45. *Dāvisii*, Engelm. & Bigel. A procumbent, spreading shrub, with firm, woody skeleton, 1-2 ft. high:



2606. *Opuntia acanthocarpa*.
No. 46.



2605. *Opuntia clavata*.

joints 4-7 in. long and $\frac{1}{3}$ - $\frac{1}{2}$ in. thick; areoles with short, white wool and numerous straw-colored bristles; spines usually 8-13, exterior $\frac{1}{2}$ in. or less long; interior 4-7, triangular, brownish, with lighter tips, $\frac{3}{4}$ - $1\frac{1}{4}$ in. long, very loose-sheathed; fls. greenish yellow, 2-2 $\frac{1}{4}$ in. wide; fr. clavate, 1 in. or more long, often sterile, spiny. Texas to Calif.

46. *acanthocarpa*, Engelm. & Bigel. Fig. 2606 (adapted from Pacific R. R. Report). An arborescent, erect plant, 4-8 ft. high, with dense reticulate-tubular skeleton and ascending, spreading branches; joints usually 4-10 in. long, sometimes 20, and $\frac{3}{4}$ -1 in. diam.; areoles with short, white wool and scanty bright yellow bristles; spines very variable in length and numbers on different plants, usually 8-25, $1\frac{1}{2}$ in. or less long, with loose straw-colored or brownish sheaths; fls. greenish yellow, with reddish centers, conspicuous for stamens with stout red filaments, $1\frac{1}{4}$ - $1\frac{1}{2}$ in. wide; fr. subglobose to pyriform, 1 in. diam. and usually armed with many long, stiff spines. Ariz. and Calif.—A factory has been established at Tempe, Ariz., where the wood of this species is made into light furniture, picture-frames, and the like.



2607. *Opuntia Bigelovii*.

47. *echinocarpa*, Engelm. & Bigel. A low, spreading shrub, with reticulate woody skeleton, rarely more than $1\frac{1}{4}$ ft. high; joints $1\frac{1}{2}$ -3 in. long, rarely 4-6 in., $\frac{3}{4}$ in. thick, somewhat clavate; areoles with short white wool and a few coarse, straw-colored bristles, spines very variable in length and number, exterior 8-16, $1\frac{1}{4}$ in. or less long; interior usually 4, forming a cross, 1- $1\frac{1}{2}$ in. long, with loose white or straw-colored sheaths; fls. greenish yellow, $1\frac{1}{4}$ - $1\frac{3}{4}$ in. wide; fr. depressed-globose or hemispherical and armed with many long ($1\frac{1}{2}$ in.) spines on the upper areoles. Utah, Ariz., and Calif.—The fr. of this species, like most others with dry fr., ripens in the early summer, while most species with fleshy fr. do not mature them until fall or the following spring.

48. *Bernardina*, Engelm. A slender, branched, upright shrub, 3-5 ft. high, usually with several long, straight sts. arising from the base; joints 4-21 in. long and $\frac{3}{4}$ in. thick, armed with numerous short spines; areoles with grayish white wool and numerous yellow bristles; spines yellow or brownish, 8-14, usually with inconspicuous sheaths, $\frac{3}{4}$ in. or less long; fls. greenish yellow, 1- $1\frac{1}{2}$ in. wide; fr. obovate, 1 in. long, armed with numerous rather short spines. S. Calif.

49. *serpentina*, Engelm. A prostrate, rarely ascending, sparingly branched shrub, a few inches to 2 ft. high; joints much elongated, 6-20 in. long and $\frac{1}{2}$ -1 in. thick; areoles with short white wool and whitish bristles; spines comparatively short, usually 7-9, sometimes 15 or more, yellowish or rusty, $\frac{1}{2}$ in. or less long; fls. greenish yellow, 1- $1\frac{1}{2}$ in. wide; fr. hemispherical, $\frac{1}{2}$ - $\frac{3}{4}$ in. diam., armed with numerous short spines and long woolly hairs. S. Calif., Low. Calif.

50. *prolifera*, Engelm. An arborescent, thick-stemmed plant, 3-8 ft. high, with numerous horizontal, spreading branches, the erect trunk sometimes 8 in. diam.; joints short-cylindrical, rounded at the ends, very succulent, tumid and readily detached, bright

green, 2-6 in. long and $1\frac{1}{4}$ -2 in. thick; areoles with white wool and on older joints with numerous straw-colored bristles; spines variable, usually 6-10, with conspicuous, loose, yellowish or rusty sheaths and much-barbed, usually about 1 in. long; fls. $1\frac{1}{4}$ - $1\frac{1}{2}$ in. wide, greenish red; fr. subglobose, $\frac{3}{4}$ - $1\frac{1}{4}$ in. diam., light green, with few small spines and bristles, pendulous in clusters, frequently sterile. Calif., Low. Calif.

51. *fúlgida*, Engelm. A numerously branched arborescent plant, often 10-12 ft. high, with erect trunk 8-14 in. diam., having a thick, grayish, scaly, unarmed bark; joints congested toward the ends of the larger branches, ovate to ovate-cylindrical, 2-8 in. long and often 2 in. thick, very fragile and tumid, easily becoming detached and taking root, bluish green, somewhat glaucous; areoles with white wool and bright straw-colored bristles; spines on young growth 5-8, increasing yearly until ultimately 30-50, finally deciduous, with loose, glistening, white or straw-colored sheaths $1\frac{1}{2}$ in. or less long; fls. $\frac{3}{4}$ -1 in. wide, pink; fr. obovate to globose, light green, pendulous, in large, proliferous clusters, sometimes 50 in a single cluster. S. W. U. S. and N. Mex.—The common "cholla" of the Ariz. plains, where it often becomes a fair-sized tree and notable for its formidable armor of barbed spines completely hiding the surface of the plant. Var. *mamillata*, Coult. Differs in having fewer, shorter spines.

52. *Bigelovii*, Engelm. Fig. 2607 (adapted from Pacific R. R. Report). An erect, compact plant, 4-6 ft. high, rarely higher, with fragile woody skeleton which does not appear in joints of the first year's growth, the most densely spine-covered and difficult to handle of the cylindrical opuntias; joints readily detached and forming formidable burs, ovate, short-elliptical to long and cylindrical, with rounded ends, readily breaking from the plant and taking root, pale green, fragile, tumid, terminal ones frequently 3-5 in. long and half as thick; areoles close together, with white wool and pale yellow bristles; spines 10-20, some very small, increasing in number as sts. become older, straw-colored, loose-sheathed, 1 in. or less long, completely hiding the surface of the plant; fls. greenish red, 1 in. broad; fr. very spiny, ovate, $1\frac{1}{4}$ -2 in. long and one-third as wide, few-seeded, mostly sterile. Ariz., Calif.

53. *imbricatá*, DC. A wide-spreading, irregularly branching shrub, rarely more than 5 ft. high, the trunk and larger branches with dark, rough, unarmed bark; joints frequently 12-14 in. long and 1- $1\frac{1}{4}$ in. thick, with very prominent long, cristate tubercles; areoles



2608. *Opuntia arborescens*.

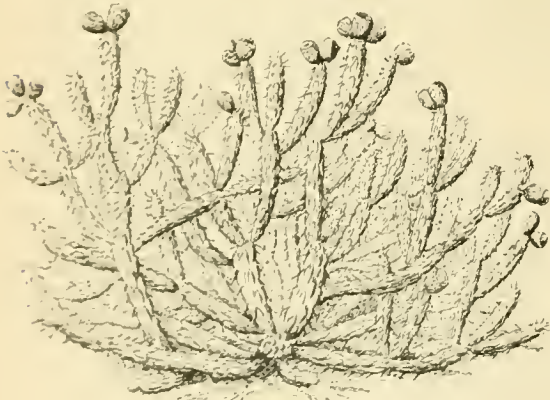
with yellowish wool and straw-colored bristles; spines 2-5, of variable length, 1 in. or less long, loosely sheathed, white to straw-colored; fls. 2-2 $\frac{1}{2}$ in. wide, light purple; fr. unarmed, depressed-globose, with large tubercles, yellow, 1- $1\frac{1}{2}$ in. diam., adhering to the plant and drying on the sts. during the winter. Texas and N. Mex.—Usually confused with *O. arborescens*, from which it differs in its smaller growth, different habit, much longer joints, larger, more prominent tuber-

cles, and fewer spines. The fr. and fl. also show marked differences.

54. *arborescens*, Engelm. (*O. stellata*, Salm-Dyck). Fig. 2608 (adapted from Pacific R. R. Report). An arborescent, numerous branched plant, 4-8 ft. high, with trunk of larger plants having very rough, dark, unarmed bark: joints with moderately prominent, narrow, cristate tubercles, verticillate, horizontally spreading on mostly pendulous, moderately spiny branches, mostly 3-6 in. long and 1 in. or less thick: areoles with dirty-white wool and small yellow to light brown bristles; spines 6-20, variable in length, 1 in. or less, central ones more loosely sheathed, horny or reddish brown, white to straw-colored sheaths: fls. purple, 2-3 in. wide: fr. unarmed or with few spines, conspicuously tuberculate, subglobose, 1 in. diam., yellow to yellowish red. S. W. U. S.—Frequently confused with *O. imbricata* and *O. spinosior*, and intermediate between the two. Differs from the latter in having much larger, more cristate tubercles, fewer spines and different fr.

55. *spinosior*, Toumey. A small tree, 6-12 ft. high, with numerous verticillate branches, forming a rounded head, the cylindrical trunk usually branching a few feet above the ground, and with rough, dark brown or grayish unarmed bark: joints verticillate and pendulous, ultimate ones usually 4-8 in. long and about 1 in. thick, dark green, frequently more or less purplish, with short, crowded rhombic tubercles: areoles with white to reddish brown wool and usually few, small, variously colored bristles; spines 10-30, increasing in number yearly as the joints become older until finally deciduous, short, and rarely conspicuously sheathed, usually $1\frac{1}{2}$ - $\frac{3}{4}$ in. long: fls. showy, bright to dark purple, 2-2 $\frac{1}{2}$ in. wide, in whorls at the ends of the joints: fr. elliptical to oblong, rarely obovate to globose, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long, yellow, frequently remaining on the stems during the second year. Ariz., N. Mex.

56. *Whipplei*, Engelm. & Bigel. Fig. 2609 (adapted from Pacific R. R. Report). A spreading, sub-prostrate shrub, rarely more than 2 ft. high, with numerous ascending secondary branches, having short, crowded, prominent tubercles: joints variable, terminal ones clavate, 2-5 in. long and $\frac{2}{3}$ - $\frac{3}{4}$ in. thick, mostly armed on upper half: areoles with short white wool and a few short, light-colored bristles; spines white,



2609. *Opuntia Whipplei*.

very variable, on terminal joints, usually from 1-3 conspicuous loose-sheathed interior ones and several small, deflexed or radiating ones: fls. greenish yellow, crowded at the ends of the joints, 1-1 $\frac{1}{4}$ in. wide: fr. unarmed or with few spines, pyriform to subglobose, densely tuberculate, yellow or tinted with scarlet, $\frac{1}{2}$ -1 in. diam., drying and remaining attached to the plant during the winter. S. W. U. S. and N. W.

Mex.—This plant is frequently confused with *O. spinosior*, probably from confusion in the original description.

57. *versicolor*, Engelm. A small, numerous branched tree, 6-10 ft. high, with rounded head and a short trunk, having smooth, light brown or reddish



2610. *Opuntia ramosissima*.

brown, unarmed bark: joints much elongated, usually 6-12 in. long, sometimes 20, $\frac{2}{3}$ - $\frac{3}{4}$ in. thick, deep green, more or less colored with red and purple: areoles with short gray wool and lighter colored bristles; spines variable, on terminal joints, usually from 5-13, older joints with 10-20, rarely, however, increasing in numbers after the second year, reddish brown, with inconspicuous, close-fitting sheaths, $\frac{3}{4}$ in. or less long: fls. bronze-colored, 1-1 $\frac{1}{2}$ in. wide: fr. pyriform to clavate, of same color as joints, never yellow, sometimes tinged with red or purple, unarmed or with a few persistent short spines, 1-2 in. long. Ariz., N. Mex.

58. *tetracantha*, Toumey. An irregularly branching shrub, 2-5 ft. high, primary branches from a stout, upright trunk 2-4 in. diam., and bearing numerous short lateral ones at irregular intervals: joints very variable in length, usually 4-10 in. long and $\frac{1}{2}$ in. thick: areoles with whitish wool and a crescent-shaped tuft of light brown bristles; spines 4, rarely more or less, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, stout, loosely sheathed, straw-colored, flattened, strongly deflexed, not increasing in numbers on older joints: fls. greenish purple, $\frac{1}{2}$ -1 in. broad: fr. obovate to subglobose, $\frac{1}{2}$ -1 in. long, juicy, scarlet, unarmed, or with a few stiff deflexed spines. Ariz.—One of the most attractive of the cylindrical opuntias on account of its numerous bright scarlet frs.

59. *arbuscula*, Engelm. A short, numerous branched, round-headed, arborescent plant, rarely reaching the height of 5 ft., but always with an upright, well-defined trunk, having rough, brown, unarmed bark: joints usually 2-4 in. long and $\frac{1}{3}$ in. wide, easily broken from the plant: areoles comparatively large, with white wool and brush-like tufts of long, slender, yellow bristles; spines yellow, usually 1, frequently a small, slender, additional one at either side, $\frac{3}{4}$ -1 $\frac{1}{2}$ in. long, loosely sheathed: fls. bronze-colored, $\frac{3}{4}$ -1 in. wide: fr. unarmed, of same color as joints, long, clavate, 1-2 in. long and one-third as wide, mostly sterile, fertile ones with a few remarkably large, irregular-spheroidal seeds. Ariz., Sonora.

60. *leptocaulis*, DC. (*O. frutescens*, Engelm.). An erect shrub, 2-4 ft. high, with long, slender, flexible sts. branching from near the ground, and numerous lateral secondary ones, very short, usually unarmed and easily detached: joints about $\frac{1}{2}$ - $\frac{1}{4}$ in. thick: areoles with short white wool and numerous reddish brown conspicuous bristles; spines usually 1, sometimes wanting, erect, stout, frequently 2 in. long, brownish or horny, with a loose yellow sheath: fls. greenish yellow, $\frac{1}{3}$ - $\frac{1}{2}$ in.

wide, with deflexed perianth: fr. scarlet, succulent, obovate to oblong, rarely globose, $\frac{1}{2}$ – $\frac{2}{3}$ in. long, frequently proliferous, armed with tufts of long, reddish brown bristles. S. W. U. S. and Sonora. Var. *major*, Hort., is advertised.—One of the slenderest of the opuntias. It differs from other species in that the fls. do not open until late in the afternoon. Several forms of this plant occur throughout its range, some of which have been separated as varieties. One of the most frequent of the cylindrical opuntias in cult.

61. *ramosissima*, Engelm. (*O. tessellata*, Engelm.). Fig. 2610. A spreading bush, 2–5 ft. high, with numerous slender branches arising from a short trunk, 1–3 in. thick, and having dark, scaly bark: joints ashy to bluish gray, variable in length, ultimate ones 2–6 in., $\frac{1}{4}$ – $\frac{1}{3}$ in. thick: areoles with sparse white wool and a few small yellow bristles; spines sometimes wanting, usually 1, stiff, erect, $1\frac{1}{2}$ –2 in. long, loosely sheathed: fls. reddish purple, $\frac{1}{2}$ – $\frac{2}{3}$ in. wide, dry, narrowly, obovate, 1 in. long, $\frac{1}{3}$ in. wide, with 1 or 2 seeds, frequently sterile, armed with numerous long, grayish bristles. Ariz., Calif., Sonora.

O. Bergeriana, A. Web. Allied to *O. nigricans*. Forming a shrub 5–10 ft. high: joints obovate or oblong-ovate, 9 in. long, $4\frac{1}{2}$ in. wide: spines varying in number and size, spreading: fls. red, over 1 in. long. G.C. III. 35:34.—*O. cantabrigiensis*, Lynch. Similar to *O. Engelmannii*, but differs in the whitish spines and broadly obovate ovary. G.C. III. 33:98.—*O. coccinifera*. Probably a hybrid. Joints cylindric, strongly tubercled, decumbent, about 5 in. long: spines golden brown: fls. yellow, $2\frac{1}{2}$ in. wide. Colo.—*O. coccinellifera*, Mill.—*Nopalea*.—*O. cornigata*, Salm-Dyck, was once advertised, but is little known.—*O. Deanii*, Rose. About 3 ft. high: joints erect or spreading, 10–12 in. long: spines 2–6, stout, white or dull yellow: fls. 3 in. long, rose-colored. Guatemala.—*O. Dillonii*, Hall. Erect: joints glaucous, obovate-rotundate: areoles clothed with yellow, eventually white, tomentose: spines yellowish, 3–5 smaller ones and stronger: fls. yellow. W. Indies.—*O. glauca-phylla*, Wendl. Erect: joints obovate, glaucous: spines 1 or 2, less than 1 in. long. Mex.—*O. Gosseliniana*, A. Web. 3–4 ft. high: st. with long bristles. Mex.—*O. hamatocarpa*, Berger, is advertised abroad.—*O. haitiensis*, Brit. Trunk 10–13 ft. high, densely armed with spines 5 in. or less long: fls. yellow to orange, 1 in. broad. Haiti.—*O. Hanburyana*, A. Web. Distinct on account of its straggling habit, long spreading spines, small ovary and fr. G.C. III. 35:34.—*O. Kleinia*, DC. Shrubby, erect: joints cylindrical, slender: spines mostly solitary: fls. cinnamon-red. Texas.—*O. lens*, Coult. Joints light green, elongate-obovate, 12 in. long: areoles small, gray tomentose, with numerous short pale bristles: fls. yellow, tinged with red, about 2 in. broad: fr. somewhat pyriform. Ariz.—*O. lutea* is probably *O. arborescens*.—*O. Mills-paughii*, Brit. Trunk 2 ft. or less high, densely covered with spines sometimes 6 in. long: fls. scarcely $\frac{1}{2}$ in. across. Bahamas.—*O. myriacantha*, A. Web. Branches yellow-green, pendulous when old: areoles clothed with clusters of yellow bristles: petals pure yellow. Galapagos Isls. G.C. III. 27:178.—*O. santa-rita*, Rose. Joints reddish, usually obovate: areoles with chestnut-brown bristles: fls. deep yellow, $2\frac{1}{2}$ –3 in. across. S. W. U. S.—*O. Schumannii*, A. Web. Allied to *O. nigricans*. Shrub, 4–5 ft. high: joints obovate-oblong, 12 in. long, about 5 in. broad: fls. $2\frac{1}{2}$ in. long. G.C. III. 35:34.—*O. Spegazzinii*, A. Web. St. and branches cylindrical: spines 5 or 6, short, whitish: fls. small, numerous, white. Paraguay.—*O. Taylori*, Brit. & Rose. Prostrate, widely branched: joints oblong to narrowly obovate, up to 5 in. long: fls. small, yellow. Haiti.—*O. tomentella*, Berger. Very free-flowering: joints 8–12 in. long, bright green: areoles clothed with short blackish wool: spines 1 or 2, slender, whitish: fls. yellow-red. Guatemala.—*O. tomentosa*, Salm-Dyck. Erect: joints lanceolate, 6 in. long: spines bristly, scarcely exceeding the tomentum: fls. reddish. Mex.—*O. utahensis*, Purpus. Prostrate: joints ascending, elliptic or obovate, swollen, about 6 in. long: areoles circular, with yellowish white wool: spines 1–4, rigid: fls. carmine, up to 4 in. across. Utah.

J. W. TOUMEY.
J. N. ROSE.†

ORACH, or French spinach, is a pot-herb cultivated and used much like spinach. It is an annual, grows 5 to 6 feet high, has furrowed stems and arrow-shaped slightly crimped leaves of soft texture. The inflorescence suggests that of amarantus-like plants. The individual flowers are very small, devoid of petals, and greenish or reddish according to variety. For a technical description, see *Atriplex hortensis*, page 427.

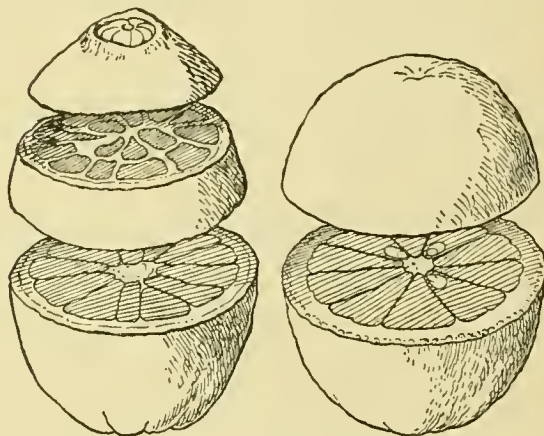
There are three main types of orach, based on the color of the leaves. The white variety is most commonly grown; the leaves are pale green, almost yellow. The red or dark red variety has stems and foliage of dark red color, which disappears in cooking; it is occasionally cultivated as an ornamental foliage plant under the

name var. *atrosanguinea*. The green variety is perhaps the most vigorous type; the leaves are rounder than those of the white variety and less toothed.

The seed is usually drilled into the open ground in early spring, and usually seedlings are not transplanted but thinned and allowed to stand in the row. The plants are used in their young state, being cooked after the manner of spinach or other "greens." They bear hot weather fairly well, but soon run to seed. Monthly successional sowings are therefore desirable. Orach is little grown in America.

WILHELM MILLER.

ORANGE. Plate LXXVIII. The orange is one of the oldest of cultivated fruits. Its nativity is still in doubt, but it is probable that it is indigenous to the Indo-Chinese region. It is now widely distributed in all warm-temperate and tropical countries, in many of which it



2611. The "navel" structure.—Normal orange on the right; abnormal or navel orange on the left, showing the adventitious cells in the center.

has run wild and behaves like a native plant. In parts of Florida the orange was found wild when permanent settlements were made, but it had probably spread from stock that was introduced by the early Spaniards.

In stature of tree and character of fruit, the orange has varied immensely. Normally, the fruit contains ten compartments or locules; but under the influence of domestication these compartments have been increased, and in some cases a secondary axis, with its accompanying locules, has been thrust into the center of the fruit, causing the "navel" appearance of some varieties (Figs. 2611, 2612). These navel oranges, of which the Washington Navel, or Bahia, is the best known, are chance kinds or varieties, as other varieties are. The immediate cause of this particular kind of variation, as of other variations, is unknown. The Washington Navel was introduced from Brazil in 1870 by the late Wm. Saunders, and by him distributed as the Bahia (see Van Deman, Report of the Department of Agriculture, 1886, page 267). The two "original" trees in California are still standing at Riverside, carefully protected (Fig. 2613). In recent years, some of the odd and grotesque types of Japanese oranges have been introduced into this country, but they will probably always be curiosities rather than commercial pomological products. See A.G. 1890, 333–336. The sweet and sour oranges are considered to be two species (pages 782–784, Volume II), *Citrus sinensis* and *C. Aurantium* respectively. To the former belong nearly all the usual commercial oranges, although the King orange is *C. nobilis*, of which the tangerines, mandarins and satsumas are varieties (Figs. 2614, 2615). The orange belongs to a tribe of three-foliate plants, and although its leaves appear to be simple, they are really compound. Fig. 2616 shows

the articulation above *a*, at which point the blade is jointed to the rachis; this blade is a leaflet, and the side leaflets have not developed, as they do in the trifoliolate orange (*Citrus*, or *Poncirus*, *trifoliata*).

There are three well-developed orange regions within the confines of the United States; central and southern



2612. Orange (Satsuma). Showing the multiplication of locules or compartments.

Florida; the delta region of the Mississippi; California. Parts of Texas and the Mexico-Arizona region will no doubt develop into commercial orange sections in the near future. Until within recent years a large part of the oranges consumed in this country had come from Mediterranean regions, but the Florida and California oranges have taken the place of the imported fruit.

Oranges under glass.

Years ago, oranges were commonly grown under glass in England and parts of the continent. At that time there was no rapid transportation between the orange-growing regions and northern countries, and the orange fruit was a luxury. Special houses, known as "orangeries," were devoted to the culture of the fruit. The trees were ordinarily grown in large tubs or boxes, and were kept in the open in summer and were placed in the orangery in winter. These orangeries were scarcely greenhouses in the modern understanding of the term. In many cases they had slate or shingle roofs, the sides only being provided with an extra extent of glass in the shape of windows. Some of them, however, were houses with glass roofs. As imported oranges came to be more common, these orange-houses gradually fell into disuse. It is doubtful whether there are any of these establishments now standing in this country; but one sees them sometimes in Europe. As the orange trees disappeared, other plants were grown in the house, so that an orangery came to mean a particular kind of house in which plants are grown that will thrive in conditions suited to the orange. It came to be no uncommon thing to see orangeries in which there were no oranges.

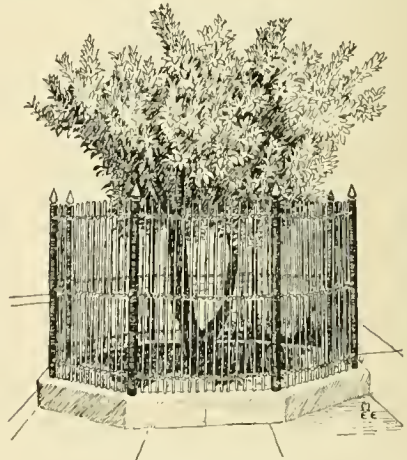
The orange tree is still a popular subject in conservatories, however, and in window-gardens. In the latter conditions it rarely produces fruit of any consequence, but the shining evergreen foliage and the very fragrant flowers make the plant interesting and desirable. The plant is subject to scale and mealy-bug, and constant attention must be given to syringing and sponging the foliage. The leading difficulty in the rearing of an orange tree in the dwelling-house is a tendency to have it growing the entire year and to keep it too wet at the roots. After the fruiting season, in late autumn or early winter, the plant should be allowed to rest for a time in order to harden its wood for the next year's bloom. It may then be kept at a temperature of 40° to 50° and fairly dry at the roots. Water should not be withheld entirely, however, because the plant should be kept in such condition that the foliage will not drop. After a period of relative inactivity of one or two months, the plant may be set in a sunny place and given a somewhat higher temperature, and water and liquid

manure may be applied at the roots. It should be in bloom in the summer and early autumn. Best results are secured if the roots are somewhat confined. When the plant is small, it may be potted on from time to time; but after it has attained the height of 5 or 6 feet, it should not be given more root-room than a small tub or a half-barrel. Ordinarily, it will not need repotting for several years at a time after it has attained this size. Some of the surface soil may be removed from time to time and fresh soil added and liquid manure applied. Usually the plants are grown from seeds, and they vary as peaches or apples do. Some of the plants may give desirable fruit, but the larger part of them will give fruit of indifferent or even inferior quality. If the best kind of fruit is wanted, the young plants should be budded after they are well established in the pots. Buds may be secured from any tree that bears a desirable fruit, or they may be brought from the South.

In recent years the Otaheite orange (described in Volume II, page 785) has come into prominence as a pot-plant. It is known botanically as *Citrus taitensis* (Fig. 2617). It is undoubtedly the best form of orange for growing in the house. The fruits are small and handsome, and the flowers have a pinkish tinge and are very fragrant. These plants will bloom and bear when not more than a foot high if the roots are somewhat confined or the plants not over-potted. Usually they will bloom the greater part of the year, but, like most hard-wooded plants, the best results are secured if they have a period of rest, as indicated above. The temperature for all oranges should be relatively low; that is, it should be the temperature of the intermediate house or one that will grow carnations, chrysanthemums, geraniums, and the like.

Literature.

There is much literature on the orange, a large part of it in the form of bulletins and reports. An authoritative general work on oranges is Risso and Poiteau, "Histoire et Culture des Oranges," Paris. On the oriental forms and histories of oranges, one should consult Bonavia, "The Cultivated Oranges and Lemons of India and Ceylon," London, 1890. The American books on the orange are as follows: Hume "Citrus Fruits and



2613. One of the two original Washington navel oranges still standing in California.

Their Culture;" Coit, "Citrus Fruits;" Garey, "Orange Culture in California;" Moore, "Treatise of Orange Culture in Florida, Louisiana and California;" Manville, "Practical Orange Culture: including the Culture of the Orange, Lemon, Lime, and other citrus fruits as grown in Florida;" Spalding, "The Orange: Its Culture in California;" also small books or pamphlets or reports



LXXVIII. A cluster of oranges.—the Pineapple variety.

by Canada, Davis, Fish, Fowler, Gallezio, Garcelon, Lelong, Prange.

L. H. B.

Orange-culture in Florida.

The Spanish occupation of Florida began with the landing of Ponce de Leon in 1513, and they maintained a more or less precarious hold upon the state, disputing possession with the English colonists to the northward, and with the aborigines, until the year 1821 (excepting the years 1763-1783), when it passed under the control of the United States. It was during the Spanish régime that oranges were first grown in Florida, and there is reason to believe that as early as the year 1600 the orange was fairly well established on the Florida peninsula.

As in the early days of orange-culture in Spain, the sour orange (*Citrus Aurantium*) was the fruit cultivated, so in Florida it is not unlikely that the earliest Spanish importations were of sour orange fruit from which seed was secured. At any rate, when the early English colonists made their homes in Florida, they found the sour orange much the more common, although some sweet orange groves were also found. One of the most noteworthy of these sweet orange groves was found in 1823 in Turnbull Hammock near Hawk's Park. It was from this grove that the old strains of oranges which made the Indian River famous came. The old sour orange groves were found mainly on the shores of lakes and rivers, where the fruit had been brought and consumed by the Indians and where the seeds, thrown aside by them, found a congenial soil for germination and growth. The trees were usually mixed with and protected by magnolia, live oak, and other hardwood forest growth. These natural sour orange groves were the foundation, in many instances, of important sweet orange plantings, particularly in the older orange districts in the central part of the state. In some cases, the sour orange trees were topworked where they stood; in others they were taken up, planted out in orchard form and then topworked. There is no orchard cultivation of the sour orange in the state at this time.

The earlier sweet orange groves in Florida were established near lakes and rivers because these afforded the only means of getting the fruit to market. These plantings were made almost entirely with seedling trees, and in spite of the ravages of mal-di-gomma and frost, in many regions they furnish a very large proportion of the crop at the present time. Nor is its quality open to question. In the early sixties there were many famous groves along the St. John's River, but it was not until the railroads opened up the state that the growing of citrus fruits took its place as Florida's most important horticultural industry.

Previous to the severe frost of 1894-5, much fruit was produced in northern Florida, but while some is still grown, the industry has been gradually moving southward, until now the larger part of the total crop comes from the southern part of the state.

Climate.

The Florida climate is usually marked in spring by a pronounced dry period which extends from the latter part of March or early April up to the beginning of the summer rains, which generally commence in June. During June, July, and August, the rainfall is uniform and heavy. The autumn months are fairly dry, while showers are intermittent during the winter season, with a very large proportion of days of bright sunshine. The annual average rainfall is 53 inches, most of which comes during the summer months.

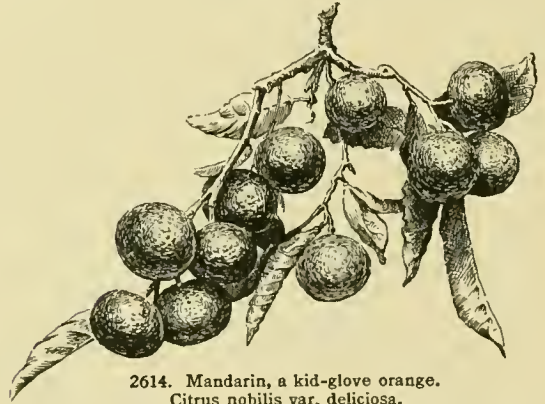
Florida has been visited from time to time by severe cold waves. Among these, the most noteworthy were the ones which came in 1886 and in 1894-5. At the time of these cold waves, the orange industry was established in the more northerly counties of the state

and consequently the damage was much more serious than would occur at the present time, owing to the opening up of the southern districts. The damage from cold waves in Florida has often been greatly increased because they were preceded by periods of high temperatures which caused sap movement in the trees. When entirely dormant, an orange tree is fairly hardy, while, in growth or when stirred from its dormant condition, it may be injured at comparatively high temperatures. This, however, is more or less true of other plants, though they do not respond so readily to variations in temperature. But in Florida, many fruit-trees and ornamentals entirely hardy much farther north have been injured at times because they were not completely dormant.

Soils.

Florida lands are generally grouped according to elevation and the growth of native timber or vegetation by which they are, or were, covered in a virgin state. Those commonly used for the cultivation of citrus fruits are high hammock, and low hammock, high pine and flat woods land.

High hammock lands are elevated, naturally well drained, and are covered with a native growth of ever-green hardwood and deciduous trees. Among these



2614. Mandarin, a kid-glove orange.
Citrus nobilis var. *deliciosa*.

may be mentioned the live oak, hickory, magnolia, dogwood, and holly. They are well supplied with vegetable matter, the soil is comparatively rich, deep and well adapted for citrus fruit-culture.

Low hammock lands (hammock is an Indian name for a hardwood forest) correspond in a large measure to the high hammock soils. They are not so well drained naturally. The native growth is of much the same character, but the sweet gum, live oak, and cabbage palmetto are more in evidence. Drainage requires careful attention, but the soil is rich in humus. The clearing and preparation of these low hammocks for planting is difficult and expensive, but the results in vigorous orange trees and crops of fine fruit leave little to be desired.

High pine land is well drained, elevated and often rolling. The native growth consists almost entirely of long-leaf or yellow pine with little or no undergrowth, the latter being replaced by wire-grass. Sometimes a few high-land willow oaks are found. These lands are frequently swept by fires, and consequently the humus-content is lower than would otherwise be the case. The subsoil may be sand, clay or loamy sand. They are not rich soils, but respond readily to good treatment and produce excellent oranges.

Flat woods land is also covered with long-leaf and other pines, but the elevation is much lower and the surface flat and level. Often there is a dense growth of saw palmetto. The subsoil may be clay, sand or hard-

pan. The better class of flat woods make good citrus soils, but those supporting a heavy growth of saw palmetto or with a hardpan subsoil are not considered good, and though sometimes used are usually avoided.

In the handling of Florida soils, the most important things to which attention should be given are drainage and the maintenance of the humus-content of the soil. The rainfall is heavy at times and provision must be made for the rapid elimination of surplus moisture, while the light character of the soil, high temperatures and moist condition assist in the rapid disintegration of the vegetable matter. A water table about 3 feet below the surface is desirable.

Stocks for citrus trees.

Intimately associated with the character of the soil is the kind of stock which should be used for the orchard. The seedling sweet orange as a foundation for a young orchard is a thing of the past and at this time only trees budded on stocks of different kinds are used.

The stocks more or less commonly used for orange trees in Florida are sour orange (*Citrus Aurantium*), rough lemon (form of *Citrus Limonia*), grapefruit (*Citrus grandis*) and trifoliata (*Poncirus trifoliata*). Each has its peculiar advantages for certain soils and climatic conditions.

No stock is more commonly used in the world's citrus regions than the sour orange. Trees propagated



2615. Satsuma orange.—*Citrus nobilis* var. *unshiu*. ($\times \frac{1}{2}$)

on it are long-lived, vigorous, and produce fruit of high quality. The stock itself is resistant to maldigomma and some other similar diseases which affect other stocks. Wherever it can be used, it should be given preference. It is a congenial stock for all important varieties of oranges, the Satsuma alone excepted. This variety does not grow well upon it. The sour orange tree itself

is more resistant to cold than the sweet oranges usually worked on it. It is adapted to low hammock, high hammock, flat woods and to high pine land soils where the latter are not too porous, open, and deficient in moisture. If fruit is to be held on the trees later than its season, or for late-maturing varieties, it has no superior. Rough lemon stock produces more vigorous tree-growth than sour orange stock. The root-system is widespread and rather shallow. It is much more tender than the sour orange and trees budded on it are not so cold-resistant. It is not desirable for early varieties as the fruit is not well filled and juicy, and fruit borne by trees budded on it cannot be held very much beyond its season without parting with its juice. It is adapted to conditions where a comparatively shallow root-system is advantageous and to very light sandy soils where a root-system of wide foraging range is necessary.

Grapefruit stock, used in a limited way, produces high quality fruit and is adapted to soils containing liberal amounts of moisture and with rather high water-

tables. Where it can be used, it gives very satisfactory results. If the soil is underlaid with clay, close to the surface, so much the better. Grapefruit stock is entirely unsuited to dry open porous soils. In point of hardness and resistance to cold, it ranks with rough lemon.

Poncirus (Citrus) trifoliata, commonly referred to as trifoliata stock, is the hardiest citrus stock now in general use in America. The tree itself will stand 22° F. at least and it imparts a certain measure of its own hardness to the orange that is worked on it. This, in the main, is brought about by its very dormant character. In this combination is a noteworthy example of an evergreen tree budded on a deciduous one. Trees budded upon it do not start into growth so readily nor so early in spring. The fruit produced on this stock is smooth, thin-skinned, very juicy, and of high quality even with the very first crops. *Poncirus trifoliata* stock is adapted to clay soils, loamy or sandy soils with clay close to the surface and to alluvial soils. It requires a uniform and goodly supply of moisture. In Florida it is used for plantings of Satsuma and other oranges in the northern and western parts of the state.

Propagation and the seed-bed.

The seed-bed in which citrus seedlings are grown is carefully prepared in advance by liming and by applying commercial fertilizers. The soil is well and deeply broken, pulverized and raked free of all roots and trash. Irrigation is usually provided, though not always necessary and may be dispensed with on moister soils.

Seeds of sour orange, rough lemon, grapefruit and trifoliata are extracted by cutting through the rind of the fruit, twisting the halves apart and squeezing out the pulp and seed into a vessel. They are then washed free from pulp and dried off slightly in the sun, just enough to remove such moisture as may remain on the seed-coats. Sometimes the fruits are allowed to decay partially, when the seed is removed by macerating in water and floating off the pulp, rind, and other refuse.

Citrus seeds will not stand drying and remain viable. If they are dried, the cotyledons separate and they will not germinate. Seeds may be kept several weeks, or even months, by drying off on the outside and packing in pulverized charcoal in tight receptacles. It is best, however, to plant sour orange, rough lemon, and grapefruit seeds immediately after they are extracted in December and January. Trifoliata seed is best extracted in September and October and planted at once in soil containing considerable moisture, yet well drained. Frosts are very injurious to young citrus seedlings of all kinds except trifoliata. If frozen off when 1 or 2 inches in height, they are killed out, but trifoliata develops shoots from buds lower down on the stem and the stand is but little injured.

Seeds are planted much as garden beans are planted, in rows 2 feet apart. Frequent cultivation is given from the time the plants come through the soil, and fertilizers rich in nitrogen are applied from time to time as required by the seedlings. Damping-off sometimes causes serious losses in seed-beds, but may be prevented by spraying frequently with bordeaux mixture and by keeping the soil about the plantlets dry and well pulverized on top.

Seedlings are transplanted when one year old and 6 to 15 inches in height or when two years old and 15 to 24 inches in height. Preference is given to the larger seedlings, as they are easier to handle and care for under field conditions. The nursery rows are spaced 4 feet apart, the plants about 1 foot apart in the rows. A row is left out here and there at convenient distances apart, making an 8-foot wagon passage. About 10,000 seedlings are set on an acre of ground.

The seedlings are grown from one to two seasons in the nursery, when they are ready for budding. While citrus trees may be propagated in many different ways, budding alone is resorted to in nursery practice in

Florida. By far the greater number of trees are dormant budded, the buds being inserted by the ordinary inverted shield method, the cross cuts being made at the bottom of the downward incisions and the buds shoved up from below. Wrapping is usually done with strips of waxed cloth. These are allowed to remain on



2616. Compound leaf of orange, with only one leaflet.

from ten days to three weeks, depending upon weather conditions. Frequently, in the colder sections, these dormant buds are banked with earth, using a plow and a celery-hiller, to protect them against possible frost-injury in winter. In spring, the seedling tops are cut off and a stake driven beside each bud, to which it is tied as it grows. These stakes (4 feet long and $\frac{3}{4}$ inch square, made of cypress) insure straight trunks on the young trees and prevent the buds from being broken off when young and succulent. Careful attention is given to keep off all sprouts which come out on the stock and on the bud growth too low down. The work of sprouting and tying requires each bud to be handled five or six times by competent workmen, during the summer growing season. This adds greatly to the expense, but is necessary in the production of quality stock. At about 30 inches, the buds are topped and allowed to branch. Good buds of one season's growth will caliper $\frac{1}{2}$ to $\frac{7}{8}$ inch, 2 inches above where the buds were inserted. Usually the buds are placed rather close to the ground.

One-year buds are used by many planters, but two- and three-year buds are preferred by many, particularly among the older planters. These latter trees caliper from 1 to 2 inches, depending upon the variety and the stock on which they are grown.

Planting.

Opinions vary considerably as to the best distances at which to set orange trees in Florida, but 25 by 25 feet may be taken as a reasonable distance for standard sorts, or sixty-nine trees to the acre. Some prefer to set trees farther apart one way than the other, as 20 by 30 feet. Satsuma is usually planted 20 by 20 feet. The rectangular system is used almost entirely.

Land is prepared for planting, by plowing deeply and pulverizing thoroughly. Nearly all Florida soils are greatly benefited by applications of lime, and by having a cover-crop of some kind grown on them during the summer and turned under the autumn before planting. This increases the humus-content of the soil and leaves it in the best possible condition for the trees.

Sometimes orange trees are planted out during the early summer months, just after the summer rains set in; but by far the best season for planting the trees is during the winter months of December, January, and February. Planting should not be delayed too late, as best results are secured if the trees are established in advance of the dry spring period, which usually begins in March.

In the actual setting of the trees, the chief points to be observed are (1) that the roots be not exposed, (2) that the trees be set at the same depth as they grew in the nursery row, (3) that the soil, naturally rather open, be well packed and firmed about the roots. Balled trees are not used in Florida on account of the character

of the soil, nor are they considered necessary. Water at time of planting is advantageous, as it helps to settle and pack the soil about the roots, and at times there is an actual lack of moisture to be supplied. Surface soil is used in filling in about the roots and some commercial fertilizer is often thoroughly mixed with it, from a half-pound to a pound, depending upon the size of the trees. The use of stable manure is not advisable.

Cultivation.

Clean cultivation throughout the year, though at one time attempted in Florida, is a practice which has entirely disappeared. It did not take many years to demonstrate that it was a failure, because the basic necessity of maintaining and increasing the humus-content of the soil was not taken into consideration. At the present time, two systems of cultivation are in use: (1) the usual system of clean cultivation in spring and summer, followed by a cover-crop; (2) a system of non-cultivation, under which the vegetation which covers the soil is cut from time to time and allowed to mulch the surface.

By far the greater number of plantings is handled by the first system. Under the clean-culture-cover-crop or the 4-C system, cultivation begins in early spring as soon as danger of frost is past and the trees have started into growth, and is continued until about the middle of June or the beginning of the summer rainy season. During this period the grove is cultivated shallowly once every ten days or thereabouts, and a dust mulch is constantly preserved to prevent the escape of moisture from the soil. When cultivation ceases in June, a cover-crop is either planted or allowed to come on voluntarily, consisting of cowpeas, velvet beans, beggarweed or native weeds and grasses. If the growth of this crop is so rank as to make it difficult to handle in fall, it is cut with a mowing machine and allowed to remain on the ground for some time before incorporating in the soil. In autumn the cover-crop is either plowed under or cut into the soil with a disc-harrow. It is advisable to have the ground bare and free from vegetation in winter as a safeguard against fires, and when the soil is bare, the trees suffer much less from cold than when the soil surrounding them is covered by a dense mat of dead or living vegetation. On heavier soils the cover-crop may be plowed under, but on lighter soils best results are secured by disposing of it with disc-harrow, cutting it over several times if necessary. In Florida, it is not advisable to incorporate a green cover-crop with the soil. The advantage of the 4-C system is that clean culture during the spring months conserves soil-moisture when most needed, while the cover-crop during the summer helps to take care of the excess supplied by the rains. At the same time, vegetable matter is added. In handling young groves, the plan is often followed of cultivating the soil in the narrow strip along the tree rows throughout practically the whole season and growing a cover-crop on the middles. The implements com-



2617. Otaheite orange in a pot.—
Citrus taitensis.

monly used for grove-cultivation in Florida are the plow, disc-harrow, and Acme harrow.

The system of non-cultivation is followed on certain lowlands, on light soils, and, in general, where the character of the soil or subsoil makes it inadvisable to follow the 4-C system. It has also given good results



2618. Frost protection. Movable shed with cloth sides and board top, for protecting young trees. It is not used commercially.

under conditions where the 4-C system might be used, and is followed because less expensive and the trees thrive under it. The plan is to give no cultivation at all, except when the trees are young, only to hoe the weeds and grass immediately surrounding the trees. This same end is secured in many cases by mulching heavily with weeds, grass, leaves or trash of any sort. From time to

time, the mower is used to cut down the growth of vegetation. It is allowed to remain where it falls. There is no question but that fine fruit is produced under certain conditions by this system, but much depends upon the character of the soil and the moisture available.

Cover-crops.

The plants commonly used in Florida for cover-crops are beggarweed, cowpeas, velvet bean and its relatives, and native weeds and grasses. Cowpeas and velvet beans are better adapted for new soils, those only recently brought into cultivation. These crops are also very valuable for preparing soils for planting. A good stand of cowpeas may be secured on almost any Florida citrus soil if planted at the right season. But the best cover-crop for Florida orange groves is beggarweed, either alone or combined, as it most usually is, with a number of other native plants. These latter appear without the necessity of seeding them.

Beggarweed is a strong, erect annual legume, a native of Florida, and thoroughly adapted to all parts of the state. When standing apart, with plenty of room for growth, it is a much-branched plant, but, when closely planted, it produces small straight stems. Nitrogen tubercles are produced in abundance on its deep roots. At the end of its season's growth, a good covering of partially decayed foliage covers the ground. Often it is best to cut it once during the season to prevent its getting too rank and heavy. If cut at the blossoming season, a second crop will come on from the stubble. As much as one to two tons of stems and leaves may be produced to an acre. From five to ten pounds of seed are sown to the acre in April and May, broadcasted and harrowed into the soil. After the crop has become well established, it reseeds itself from year to year and cultivation may be continued up to the rainy season without interfering with the crop. It will come on as soon as cultivation ceases. If it be deemed advisable to stop the growth of beggarweed in a grove, as is sometimes the case if there is too much nitrogen in the soil, it may be accomplished by cutting frequently to prevent seeding and by continuing cultivation later into the summer.

Pruning.

The general plan followed in Florida orange-growing is to give the trees but little pruning. Beyond shaping up the trees, mostly done while they are young, little is done except to remove dead, injured or diseased branches. The type of trees developed is low-headed, symmetrical, and spreading. The low-headed tree is almost the only form seen in the younger groves and as the advantages in shading the ground and the tree-

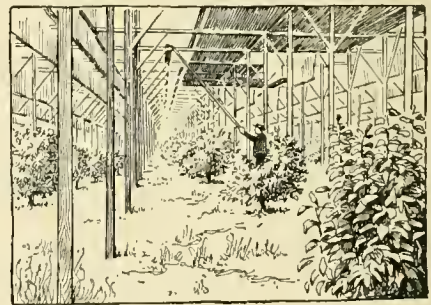
trunks, in spraying and in harvesting, are all in its favor, it is not likely to be displaced.

Fertilizers.

In no citrus region have the problems connected with the fertilizing of orange groves received more attention nor has a greater amount of definite knowledge pertaining to this difficult problem been secured than in Florida. The kind and quantity of fertilizer used has a pronounced influence, not only upon the quantity and quality of fruit, but upon the growth, health and longevity of the trees, and it has taken many years to determine the value of different materials in the fertilizers applied. Much remains to be found out, but a good start has at least been made.

The leguminous cover-crops referred to, when rightly handled, supply a large part of the necessary nitrogen, but the fertilizers applied to orange groves in Florida are drawn almost entirely from commercial sources. Potash is used largely in the forms of high- and low-grade sulfate of potash; phosphoric acid is secured from bones and phosphate rock, while nitrogen is procured from nitrate of soda, sulfate of ammonia, and from organic sources such as blood, tankage, cottonseed-meal, castor pomace, and the like. Much care must be exercised in the use of nitrogen in organic combinations because they are prone to induce "die back," a physiological disease characterized by the exudation of gum on twigs, leaves, and fruit. The several materials entering into the composition of fertilizers, as sulfate of potash, sulfate of ammonia, and acid phosphate (for example) may be purchased separately and mixed by the grower in proper proportions, but more usually they are mixed by the fertilizer manufacturers and sold as complete fertilizers.

Fertilizers for nursery trees, and plantings which have not reached bearing age, contain about 6 per cent phosphoric acid, 4 per cent ammonia, and 6 per cent potash, while for bearing trees one containing approximately 8 per cent phosphoric acid, 4 per cent ammonia, and 10 or 12 per cent potash is commonly used. These percentages are of course not absolute, as the exact composition must be governed by the character of the soil, the condition or requirements of the trees, and crops. Growers watch the behavior of their trees carefully and are governed in the use of fertilizers by their general appearance.



2619. A stat shed formerly used to some extent for the protection of orange plantings in Florida, but now discarded.

Lime is very generally deficient in Florida citrus soils and the trees and fruit are much benefited by applications of ground limestone, broadcasted over the surface at the rate of about two tons to the acre.

The general tendency in the use of commercial fertilizers is to make frequent applications of small amounts, thereby preventing loss from leaching. Applications, by many growers, are made in February, April, June, and September. The composition of these applications is often varied, giving larger amounts of nitrogen in spring and larger proportions of potash in

autumn. Young orange trees are fertilized roughly on a basis of one pound to two pounds for each year of age and bearing trees according to their size and crop indications; sometimes as much as thirty or even fifty pounds a tree in the year is applied in the several applications to the latter. These amounts may even be exceeded if the crop in sight justifies.

In fertilizing young trees, the fertilizer is scattered in a band 2 or 3 feet wide, beginning back 6 to 12 inches from the trunk. As they become older, the fertilizer is spread out toward the ends of the branches and in old orchards or groves it is broadcasted over the whole surface, as the roots have made their way into all parts of the soil. After each application of fertilizer the ground is usually cultivated.

Insects and diseases.

The insects which cause most damage in Florida orange groves are the white-fly (*Aleyrodes citri*), scale insects of different kinds, and the rust mite. In insect-control, fumigation has been carefully tried out but has not met with general favor, and by most growers spraying is considered more satisfactory and practicable. Against the white-fly and scale insects, miscible oil and whale-oil soap sprays are generally used; and against the rust mite, sulfur in some form is effective. For the control of white-fly and scales, most of the spraying is done in the winter dormant season, one thorough application usually giving satisfactory results. Spraying for rust mite is done during the summer months as it injures the skin of the growing fruits, and three or more sprayings are generally necessary. In Florida, beneficial entomogenous fungi are very effective in holding scale insects and white-fly in control.

Among the fungous diseases the most injurious are melanose with which is associated the stem-end-rot, and anthracnose or wither-tip. These may be handled by careful attention to grove sanitation, removing diseased fruit, pruning out dead and injured wood, and by spraying with bordeaux mixture. "Die-back," a physiological trouble to which reference has already been made, may be corrected by changing the method of cultivation and the fertilizer used. The common method is to discontinue cultivation entirely, and use no fertilizers or those drawn only from inorganic sources and rich in potash.

Citrus Canker, a bacterial disease caused by *Pseudomonas citri* (see also page 2375) has gained a foothold in Florida and threatens serious injury to the citrus industry. The authorities are meeting with success in their determined efforts to stamp it out. No attempts have been made at control, the method of handling it being to burn the affected trees where they stand.

Frost protection.

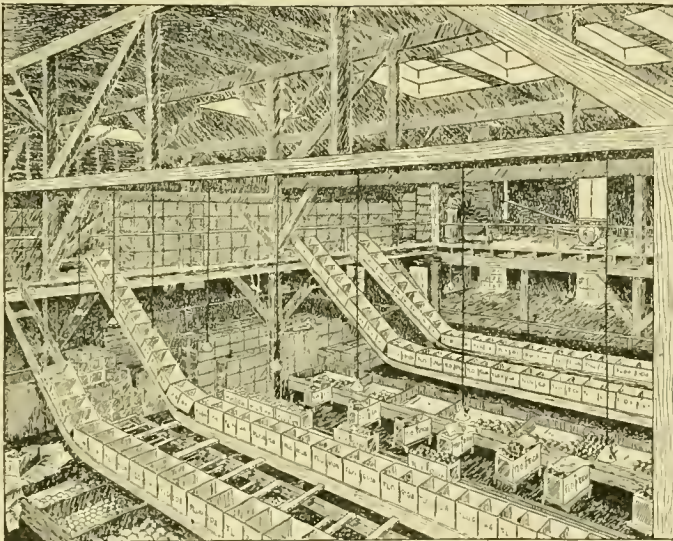
Within recent years much attention has been given to the protection of orange groves against cold. Many different methods have been tried, but protection by

means of sheds, tents and the like has been abandoned except for strictly amateur purposes (Figs. 2618, 2619). The trees were not fruitful under the artificial conditions created, or the methods were too costly. In the more exposed sections, the trees are still banked with clean earth, sufficiently high to afford protection to the bud unions. But the chief method of protection is by firing with small wood-fires or with oil-heaters.

Harvesting and marketing.

The season for Florida oranges extends from the latter part of October until June. This is divided into two parts by the Christmas holidays. At that time but little is shipped. Unfortunately, it has been the custom to ship fruit that is green and unfit for consumption. Attempts have been made to correct this mistake by laws and these have helped greatly.

Perhaps the greatest change in harvesting and marketing in the last two decades has been in the disappearance of the small individual packing-house. Most orange groves in Florida are small, 10 to 25 acres, and formerly nearly every owner had his own packing-house and picked, packed, and shipped his own fruit under his own brand. Now the marketing of the crop is in the hands of the Florida Citrus Exchange, or of individuals or companies operating on a large scale, and the fruit, in large quantities, is handled through centrally located packing-houses equipped with every convenience for the rapid and economical preparation of the fruit for market (Fig. 2620). This noteworthy change



2620. A Florida orange packing-house.

has brought about a great improvement in the methods of handling and the uniformity of the pack. Every detail of picking, hauling, handling, packing, and shipping has been carefully investigated and many improvements have been introduced. As a result, the value of the Florida orange in the markets has been greatly increased by the care taken in handling it.

The standard Florida orange box, the size of which is fixed by state law, contains two compartments, each 12 by 12 by 12 inches, or 2 cubic feet of fruit. Oranges of the mandarin group are put up in half-boxes, two of which are fastened together for shipment, known as a "strap." The fruit is arranged in the box according to definite diagrams for each size.

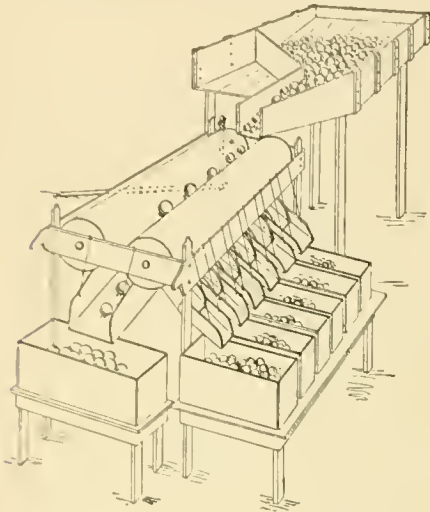
The Florida orange crop has been gradually increasing. In the season of 1914-1915, approximately 7,000,000 boxes were produced.

Varieties.

Of the mandarin group, the varieties planted are Satsuma (in the northern part of the state), Dancy, Tangerine, and King. The Dancy originated in Florida; the other two are introductions.

A great many varieties of sweet oranges have originated in Florida as noteworthy seedlings in different groves. Perhaps in no fruit-growing region of America was the amateur spirit more strongly developed or was

more interest taken in the merits of different varieties. Formerly a great many different sorts were planted, but gradually the most of these have been eliminated until only a few remain. Of these the most important, arranged according to season of ripening, are, Parson Brown, Homosassa, Pineapple, Ruby, Valencia Late



2621. A sizer or grader for oranges. (Wester.)

(Hart's Tardiff, Hart's Late), and a recent introduction, Lue Gim-Gong, remarkable because of its late-keeping qualities. Of this list, all originated in Florida except Ruby and Valencia. These are introductions from Europe.

H. HAROLD HUME.

Orange-culture in Louisiana.

From the early settlement of Louisiana to the present day, orange-culture has received most attention in the lower Mississippi delta, but for several years past, the other coastal lands have produced fruit in some quantity, and more recently, plantings of the hardy Satsuma variety in particular have been made in the interior sections of the southern half of the state. Originally, the seeds of sweet oranges were planted and the young trees transplanted in and around the home yards and gardens; and, to a slight extent, this method of growing trees is practised yet by individuals. No extensive groves were grown until after the close of the Civil War. At first, groves of these seedling trees only were planted and they proved exceedingly profitable up to the very cold spell of 1895, which destroyed nearly every one in the state. Another freezing calamity, occurring in February, 1899, utterly killed every tree to the ground.

In the meantime, extensive experiments had been made in budding the choice varieties of sweet oranges on various kinds of stocks, and many of the trials demonstrated the power of resisting moderate freezes by certain kinds of root-growth, notably the *Poncirus trifoliata*. Accordingly, many of the old groves and numbers of new ones were planted in budded stocks, using the buds of selected trees of sweet oranges and establishing them upon the *Poncirus trifoliata*. The success of this method also led to the growing of grapefruit or pomelo, mandarin or tangerine, and Satsuma and kumquat upon the trifoliata stock.

Budded stock has thus almost entirely superseded sweet seedlings. The sour orange, the bitter-sweet orange, the rough lemons, the grapefruit or pomelo, and the *Poncirus trifoliata* have all been used successfully as stock for the sweet orange. Meanwhile, with the introduction of the hardy Japanese varieties,

including the Satsuma, mandarin or tangerine, these were also budded upon various kinds of stock. In 1895, when the temperature fell to 15° F. in New Orleans, the only trees able to survive this cold were found to consist of the combination of the hardy Japanese varieties budded upon the *Poncirus trifoliata*. This experience caused the adoption of the trifoliata as the chief stock for future groves. Therefore, nearly all of the groves planted since that time have been made with this stock.

Account must be taken of a frost limit beyond which this combination succumbs to the effects. Such results were evidenced by the unprecedented freeze of February, 1899, which practically wiped out every kind of citrous growth. Since that time, orange-growing made very slow progress for a long time, but gradually the ground was replanted and the industry expanded until plantings are now scattered over most of the southern half of the state, and, at present, many large groves are to be found. Under suitable attention, the industry has brought profitable returns, and the fame of the Louisiana Sweet, also called "creole orange," is widely known for its excellence. These names apply to a great variety of strains, but all are of a type originally introduced from southern Europe and developed by select cultivation. The budded trees bear early and yield in three to five years after being transplanted in the grove. The city of New Orleans furnishes a home market for most of the crop that is raised in the delta, although large shipments are made to northern points. Local consumption generally absorbs the supply grown in other sections.

The Louisiana orange matures ahead of the Florida fruit and is also ready before the California crop ripens, and, therefore, reaches the market when, on account of scarcity, good prices prevail. These facts, coupled with the readily productive soil, seldom requiring any fertilizer, and the abundant rainfall, dispensing with irrigation, make orange-culture attractive in Louisiana.

Frost protection.

The most serious drawback is an occasional cold blast from the North in winter or early spring, which drives Gulfward, overcoming the usually balmy weather and temporarily chilling the growth. At rare intervals, such as have been mentioned, a blizzard occurs so intense as to kill the trees outright. How to protect groves against these destructive frosts is an important matter with the orange-growers. Flooding the orchard with water drawn from the adjacent river or bayou, upon the approach of a freeze, has been practised upon a large scale without complete success. The use of oil-burning orchard-heaters, or smudge-pots, comes nearest to solving the problem, and some enterprising growers are equipped with outfits. Other producers sometimes resort to building smudge-fires on the ground. The practice of banking the trees by piling the soil around the trunk to a height of a few feet more or less (Fig. 2622), on the approach of a freezing spell whose intensity and time of coming are usually predicted by the government weather service, is very largely adopted as the next best economical protection against excessive cold. This banking retains vitality in the main trunk, and while the outer limbs may be killed, young shoots will start from the tree when the soil is removed and spring advances. This practice, therefore, gives only partial protection. Should the tree be frozen so as virtually to cause the death of the growth, new shoots from the protected trunk will soon appear, and in a year or two the tree resumes shape and becomes ready to bear a crop. Although the yield is lost for the ensuing interval, yet, by skilful care, the grower is enabled to secure a renewed orchard quickly. A trial with shelters built to cover the trees has shown them to be very expensive and, further, caused shortage of yield by shading the growth in summer.

Insects and diseases.

Unfortunately, not enough attention has been given toward preventing the introduction of pests, both insects and diseases, nor to accomplish their control after becoming established. Consequently, through carelessness and neglect principally, the pests have spread nearly everywhere and made many trees unproductive. The leading growers have been compelled to fight these enemies in order to produce clean fruit in sufficient quantity to make commercial growing pay. Added to the cost of spraying groves regularly, some packers clean and polish their fruit, which process involves an investment in a properly equipped plant and further labor for the purpose. The chief insect foes are the citrus white-fly (*Aleyrodes citri*), the purple scale (*Lepidosaphes beckii*), Glover's or long scale (*Lepidosaphes gloverii*), and the chaff scale (*Parlatoria pergandii*). Recently, the cottony cushion or fluted scale (*Icerya purchasi*) has appeared to a limited extent in one locality. With the advent of the Argentine ant (*Iridomyrmex humilis*), the attendance of this pest upon scale insects has greatly increased the abundance of the latter and complicated the problem of their control. Russetting of fruit, due to infestation by mites, occurs in some places.

Following the discovery of the canker disease in 1914, many thousands of nursery stock plants and numbers of older trees were entirely destroyed by cutting and burning in efforts to eradicate this incurable evil. The danger of this menace has brought the growers to a realization of the need of having adequate state protective measures provided for the industry. Awakening to the necessity of aiding in the development of citrus culture, the General Assembly in special session during 1915 appropriated \$5,000 for eradication of canker, other diseases, and pests. This recognition, however, gives some hope that sufficient provision will be made by the state in the near future to bring it to the fore rank in horticultural prosperity through the suppression of enemies and the promotion of all fitting lines of fruit-growing. The leading orange culturists have effected an organization called the Louisiana Citrus Growers' Association, whose object is to protect their interests against natural foes.

Propagation.

The propagation of oranges is effected directly from seed and from buds. Budding is done at any time of the year from early spring to late fall. When performed in the fall, the buds remain dormant through the winter. The various stocks have particular merits for special soils and other conditions, and several kinds are used, as already said; but when the chief obstacle to successful orange-culture is cold, all other considerations must be dispensed with and only the most resistant stocks used. These stocks, are, first, *Poncirus trifoliata*, and, second, sour orange. The latter, however, is not very well adapted to the climate much north of the latitude of New Orleans. Hence, nearly all Louisiana groves have been propagated on these two stocks, a large part being on the former.

Planting a grove is always preceded by a nursery, and though home-grown stock is being produced in extensive quantities, most trees for planting are yet brought from outside of the state. The nursery is started by planting the seed of the *Poncirus trifoliata* or sour orange. When the shoots are one to two years old, they are shield-budded with buds from selected varieties, or rarely grafted to obtain the desired kind of top-growth. One year later, as a rule, the combined growth is large enough to be planted out in groves.

Soil and fertilizer.

The soil selected for groves is first thoroughly prepared and pulverized, and needs to be well drained. The trees are planted at intervals of 12 to 20 feet (some-

time more or less) apart both ways, and the grove is cultivated until the trees become large enough to shade the ground. After that period, only the weeds and bushes are kept down. Very early or late cultivation of trees is usually discouraged, as having a tendency to induce a too luxuriant, sappy growth, which may be injured by subsequent frosts. The cultivation is usually performed with light plows or suitable cultivators.

A fertilizer containing fifty pounds of nitrogen, fifty pounds potash, and twenty-five pounds phosphoric acid to an acre is the one usually recommended in this state. Of course, special requirements should be considered, depending on the age of trees. Sometimes on rich soils, only a dressing of lime or bone-meal is needed. Truck or leguminous crops may be advantageously grown between the rows of young trees.

Yield.

In three years after a grove is planted, the trees should begin to bear, increasing their products every year thereafter, and becoming profitable at five to six years of growth. When ripe, the fruit is carefully gathered by hand with clippers, using ladders to reach the high limbs, then assorted and packed in boxes, and shipped to market, generally in New Orleans.

Some idea of the status of production may be obtained from figures secured in 1915 by the entomologist in charge of Tropical and Subtropical Fruit Insect Investigations of the United States Department of Agriculture, having a station in New Orleans. According to the data applying to 361 groves, the yield is classified proportionately as follows: sweet, 63 per cent; mandarin, 20 per cent; tangerine, 5 per cent; navel, 7 per cent; pomelo, 3 per cent; Satsuma, 1 per cent; and Valencia, kumquat and miscellaneous, 1 per cent. On an average, 108 trees are planted to the acre. In Plaquemines, St. Bernard and Cameron parishes, the number of bearing trees amounted to 270,505, while 73,285 trees were found that had not yet borne any fruit. A large part of a tract of 7,000 acres, located near the city of New Orleans, has been planted in groves, and the company is proceeding in preparations to cover the whole area with one vast orchard.

The marketable crop for 1914 was placed at 275,000 boxes by a well-posted commission merchant of New Orleans. To quote his experience during the past twenty years in marketing the fruit, he says: "When my first visits were made to groves, the growers were not



2622. The banking of orange trees on the Mississippi delta.

disposed to deal with commission merchants, owing to previous unfair treatment, and the industry was entirely without organization. The growers then had no knowledge of the value of their oranges, or of how to market them. They sold their fruit to speculators, who bought it on the trees, for any price that they chose to give for the crop. These speculators' manner of handling the fruit was very crude. They pulled the oranges from the trees without the use of clippers, threw them into buckets, dumped them into boxes, hauled them to the

boats which sailed for New Orleans, and, in this unattractive fashion, offered the fruit for market in a bruised and decaying state. After educating the growers, they began picking carefully, but without any method of grading or sizing. The first packing efforts were made without using wrapping-paper, though later they were taught how to wrap the fruit. Many years passed, however, before our leading growers were induced to install modern graders, cleaners and polishers. The growers are now using labeled paper and printed boxes, and compete in the principal markets, and have been doing so for the past several seasons, with the best oranges grown elsewhere.

"Louisiana oranges are of the highest quality, being thin-skinned, sweet, juicy, and have a delicious flavor that is not found in any other orange. A number of markets take them at higher net prices to the growers than are obtained for either Florida or California oranges. A vastly greater quantity than we now raise could be handled to equally good advantage. The opportunity to market so many more than are now grown should be an inducement to an enormously increased acreage.

"Any number of growers who have shipped from 1,000 to 10,000 boxes of oranges are willing to testify that results during the past five years have been from \$1.25 to \$1.75 per box net on the trees. These prices included culls and all varieties of oranges which they grew. The production per tree compares favorably with other citrus fruit-growing sections. Our real industry, however, lies in our commercial varieties known as the Louisiana Sweet orange. This fruit comes on the market about the first of October, and shipments continue until the first of January. The season could be extended, but, on account of our limited crops, we find no necessity to hold the fruit any longer. We grow successfully the Satsuma, which begins to move in the latter part of September, and shipments are made until the end of October. Then follows our sweet high-grade mandarin; these first appear in October and last until the middle of November, sometimes extending a month longer. The tangerine starts to move about the middle of November and continues until the latter part of December. The navel orange is also grown very successfully, the only drawback being that they grow too large, as the market is limited for extra-large sizes. Valencias are ready for market in February and the season extends until March; they usually command \$1 per box more than Louisiana Sweets for the reason that the bulk of the sweet crop is then sold out, thus leaving a bare market. Grapefruit is perfectly adapted to our soil and climate. It is a large producer and of a quality equal, if not superior, to that grown elsewhere. Our prices have been very high, on account of which our growers are generally increasing their acreage of this fruit tree."

E. S. TUCKER,†

Orange-culture in California.

Orange seeds were brought into California by the Jesuit missionaries who planted the first orchard at San Gabriel Mission in 1801. The success of these trees so impressed William Wolfskill, a Kentucky trapper of German blood, that he planted the first commercial orange orchard in 1841 on the ground now occupied by the Arcade Passenger Station of the Southern Pacific Railway in the city of Los Angeles. Wolfskill was highly successful and gradually enlarged his orchard of seedling trees from 2 to 70 acres. It was he who, in 1877, shipped the first full carload of oranges across the Rocky Mountains to eastern markets.

Thomas A. Garey, of Los Angeles, established the first citrus nursery in 1865 and by propagating trees and introducing new varieties, played a prominent part in establishing the industry.

Extensive commercial development of orange-cul-

ture may be said to have begun with the completion of the Southern Pacific Railroad's connections with the East in 1876. Three years later, the exhibition of the first fruits of the Washington Navel orange at Riverside gave another impetus to citrus planting, but the greatest development came with the completion of the Santa Fe's competing line of railroad which was opened about 1885.

The strong demand for California oranges in the eastern markets and the high prices received by some, brought on a period of frenzied planting and speculation which culminated in 1882-1883, when drought, frost, scale insects, and the lack of a coherent marketing organization, conspired rudely to awaken from their golden dreams many who had rushed into the business with insufficient knowledge and capital to weather a period of depression. Since 1890, expansion has been rapid but conservative; better distribution and increased consumption have taken care of the increased production. At present (1915) production is increasing much more rapidly than consumption. The growth in production may best be shown by the shipments for the past twenty-four years:

CALIFORNIA CITROUS SHIPMENTS.
(Including all citrus fruits.)

Season	Carloads	Season	Carloads
1890-91.....	4,016	1902-03.....	23,871
1891-92.....	4,400	1903-04.....	29,399
1892-93.....	5,871	1904-05.....	31,422
1893-94.....	5,022	1905-06.....	27,610
1894-95.....	7,575	1906-07.....	29,820
1895-96.....	6,915	1907-08.....	32,729
1896-97.....	7,350	1908-09.....	40,592
1897-98.....	15,400	1909-10.....	32,648
1898-99.....	10,875	1910-11.....	46,394
1899-00.....	18,400	1911-12.....	40,673
1900-01.....	24,900	1912-13.....	18,960
1901-02.....	19,180	1913-14.....	48,548

The chief factors which have influenced the growth of the industry are: (1) The very favorable climatic and soil conditions. (2) The building of the railroads. (3) The great success of the Washington Navel variety as a regular and heavy bearer, a good shipper, and a splendid seller. (4) The protective duties imposed upon imported citrus fruits by the United States Congress. These duties have been continuously in force since July 4, 1789, although they have been changed in amount nineteen times during that period. (5) The marked enterprise of the persons engaged in the business. The California citrus business is peculiar in that the persons who have made it are, in so many cases, retired business or professional men from the East and North who, having lost their health in the acquisition of wealth, have bought and developed citrus properties, thus bringing into the industry much-needed capital, commercial ability, and business habits. (6) Coöperative packing and marketing. By this means a uniform standard pack has been established, better distribution secured, and, by uniting their strength, the growers have been able to secure from the railroads many valuable concessions. (7) The introduction of the Australian lady-bird beetle, *Novius cardinalis*, and its control of the cottony cushion scale. (8) The development of the method of refrigeration in transit. (9) Rigid inspection and quarantine methods against injurious insect pests and diseases. By this means the state has so far been kept free from the Mexican orange maggot, the Mediterranean fruit-fly, and many other damaging pests, such as the citrus canker. (10) Scientific investigations and research by the United States Department of Agriculture, the State University Agricultural Experiment Station, and the State Commission of Horticulture. (11) The great advertising activities by the Chambers of Commerce of the various cities and towns.

It is estimated that in 1915 the California citrus industry represents an investment of \$200,000,000

and gives continuous employment to the equivalent of 40,000 persons. Not less than 200,000 acres were devoted to citrous fruits at the end of 1914.

The orange-producing lands of California are scattered from San Diego to Shasta County, a north-and-south distance of 450 miles. It is a peculiar fact that there are orange orchards in California in the same latitude with New York City; Peoria, Illinois; Lincoln, Nebraska; and Salt Lake City, Utah. This is made possible by the peculiar topography of the state whereby the mountain ranges are so arranged that the cold winds of the North are shut out, and the warm southwesterly breezes from the Pacific are admitted. The great interior valleys, such as the Sacramento, San Joaquin and Imperial, are very hot and dry. The chief citrous areas of these valleys are situated on the foothills about their rims. West and south of the Coast Range, the fogs and moist ocean breezes protect, to an extent, from sudden fluctuations in temperature, and orange orchards extend from the foothills well out upon the valley floor. The factors which determine orange areas are: frequency of frosts, water-supply, transportation, and soil conditions. The greatest and most productive area embraces the country around Los Angeles, Riverside, Redlands, Corona, Orange and Santa Ana. The second area in importance is the Porterville section in Tulare County. Other important areas are in San Diego, Santa Barbara, Ventura, Kern, Fresno, Sacramento, Yuba, and Butte counties. Large extensions are now under way in Ventura, Los Angeles, Tulare, Fresno, Glenn, Sacramento and Tehama counties. On account of the higher temperatures, the interior valley oranges ripen much earlier than those grown near the coast. As some of these valley orchards lie far to the north of the coast country orchards, the unusual procedure of shipping early ripening fruits southward to market is accounted for.

Cultivation.

Almost all the old seedling orchards of early days have given place to budded trees. Several kinds of stocks are used. The most popular root at present is the Florida sour orange, because it is better suited to heavy lands and is markedly resistant to gum disease and foot-rot. Sweet orange root is desirable on light well-aerated soils. Grapefruit root is being increasingly used and is especially satisfactory on desert soils of a granitic nature. The use of China lemon root has been discontinued entirely. The rough lemon and trifoliata roots are little used, as they very rarely show any advantage over the sour or pomelo, and in many cases suffer in comparison with them.

Seeds are usually planted under the partial shade of a lath-house. They are covered with an inch of sterile sand and watered with great care in order to prevent serious loss from damping-off fungi. After a year in the lath-house, the seedlings are transplanted into the field 12 inches apart in rows 4 feet apart. After a year's growth, they are budded from 2 to 6 inches from the ground. After the bud has set, the top is cut away and the young shoot trained to a lath stake and headed at about 33 inches. Budding is done both in the fall and in the spring and early summer. Some of the more rapid-growing trees will be large enough to set in orchard form at one year from the bud, but some will require two years. Often the slower-growing trees are the more desirable, having been budded from wood with heavy fruiting tendencies. In fact, a pair of calipers is a poor gauge of the value of an orange tree. Many fine large nursery trees produce but little fruit in after years. The selection of buds is a very important matter. Oranges vary and sport much more com-

monly than apples or pears and the greatest care and eternal vigilance is necessary in order to keep the nurseries free from undesirable sports. The worthless "Austrian" or "hobo" trees which make up such a shockingly large proportion of many orchards are the result of ignorance or carelessness in selecting buds on the part of nurserymen whose only concern is to sell nursery stock.

Citrous nursery trees are usually dug and transported with a twenty- to forty-pound ball of earth about the roots inclosed in burlap. When set out, the cords are cut and the corners turned down but the sack is not removed, inasmuch as it quickly decays in the soil. Orange trees will grow just as well when dug with bare roots as when balled, provided the sun and dry desert air are not allowed to touch the moist roots even for a few minutes. There is the greatest difficulty in impressing laborers with the importance of this danger, which has led to the custom of balling trees and paying transportation charges on the extra soil as a precaution-



2623. A California orange grove.

ary measure. Balled trees retain their leaves, while bare-root trees have the leaves removed when they are dug.

The prevailing custom in California is to plant the trees in orchard form in squares 22 by 22 feet or 22 by 24 feet, the former requiring ninety trees to the acre. Great care is used to keep the bud-union above the ground and free from the soil. Yucca or paraffined pasteboard trunk-protectors are almost universally used to prevent sunburn. Often the trees are planted out ahead of canal-construction and watered for a year or two from a tank wagon.

Soils and fertilizers.

The character of soil for orange-culture is not so important as its physical arrangement. If the soil is deep, fertile, well drained, and free from layers or strata of a different physical make-up from the main body of the soil, for 5 or 6 feet in depth, it does not matter so much whether the soil is light sand, heavy adobe, loam, or disintegrated desert granite. Excellent orange orchards exist in all these types of soil. It is more pleasant and convenient to cultivate a loam than an adobe, and it is easier to irrigate a loam than a light sand. These things should always be taken into account, but the successful growth of the trees depends more on the uniformity than upon the character of the

soil. Upon shallow soils, trees will succeed for a while, but artificial feeding must be resorted to earlier. No soil less than 2 feet deep should be considered safe for oranges. Soils underlain by hardpan, or layers of open gravel are apt to cause functional derangements of the nutrition of the trees. The ideal soil is a friable easily worked loam, 8 or more feet deep, growing gradually lighter in color and texture as the depth increases. This not only provides a large storehouse of plant-food but a great reservoir to hold water. Of the two most common conditions, it is much better to have a light topsoil over heavy clay subsoil than a heavy clay topsoil over sand or gravel.

It is the custom to plow the orchards once a year, usually in the spring at the time of turning under the green-manure crop. Throughout the spring and summer, the soil is clean cultivated to a depth of 4 to 8 inches. Thorough cultivation and the reestablishment of the dust mulch follows each irrigation during summer. For this work, either disc, spike-tooth cultivators, or spading harrows drawn by three or four horses are used. Orchard tractors are beginning to take the place of horses in the interior valleys. In some soils, the oft-repeated tramping of the horses causes the formation of a "plow-sole" which interferes with the downward course of the irrigating water. This may be broken up every second or third year by running a subsoil plow through the middles in such a way as to cut as few of the large roots as possible. Some growers have abandoned all tillage and cover the ground 8 or 10 inches deep with mulch. The trees do well under this system but the mulching material is expensive and the danger from fire during the dry season is very great.

California soils are, as a rule, noted for their low content of humus. It is imperative that the humus-content be increased and maintained by generous additions of organic matter. The chief source of humus is the vetch green-manure crop, but where the trees are large and shade the ground, the growth of vetch amounts to little, and other means must be resorted to. Large quantities of stable manure, grain, hay, lima-bean straw, and even alfalfa hay, have been used for this purpose, and of late attention has been called to the possibility of using kelp, which is plentiful along the Pacific coast. How to maintain a high humus-content in the soil is today one of the chief problems before the industry.

Commercial fertilizers are commonly used and in increasing amounts from the time the trees are five or six years old. There is probably more difference of opinion and diversity in practice in connection with the use of commercial fertilizers than with any other phase of the business. The amount of application runs from two to forty pounds to each tree, annually, depending upon its size and age. Some apply the fertilizer all at one time, just before the spring plowing, while some make two or three applications a year. California soils are usually high in potassium, and wherever the humus is high, this element is hardly needed. In many cases in which the soil is deep, rich and high in humus, an annual application of ten to fifteen pounds of ground phosphate rock to a tree, together with the vetch crop and five tons of alfalfa or bean straw to the acre every alternate year will be a satisfactory program. Orange trees are very susceptible to alkali. Where the soil contains .2 of 1 per cent of total salts, the trees begin to decline. A total salt-content of less than .1 of 1 per cent is usually considered safe. These figures will vary somewhat, however, according to the proportion of the different salts, which, taken together, are known as "alkali," some of which (such as sodium carbonate) are very injurious.

Irrigation.

On none of the citrus areas of California is the rainfall sufficient. Irrigation is practised in every orchard.

For the most part, water is taken out of streams near the upper headwaters and conveyed by gravity through cement canals sometimes for hundreds of miles to the citrus orchards. Often the descending water generates electrical energy to be used in pumping additional supplies from wells. The water is distributed through steel or concrete pipe-lines and delivered at the upper end of the furrows. Usually the grower buys the water-right with the land and is assessed annually for the upkeep of the system serving him. The keys to the water gates are kept by a water-boss or "zanjero" who measures out to each grower his proper allotment. The amount of water required varies with the character of the soil and the age of the trees. Full-grown bearing trees require from 1 ordinary miner's inch continuous flow to 10 acres up to as much as an inch to 3 acres, depending on the rainfall and whether the soil is a heavy clay or an open sand or gravel. An irrigation is given every month or six weeks during the summer and less often in winter, according to the rains. In heavy soils, the water is run for three or four days at each irrigation in very small streams through four deep furrows to each tree row. The water is cut off when tests with a soil-tube show the soil to be soaked 5 feet deep. In very light porous soils, it is necessary to throw up ridges each way, leaving each tree in the center of a large basin. These basins are filled quickly with a large stream. It is only by the use of large, rapid streams that water may be conveyed across and distributed over such open and porous soils.

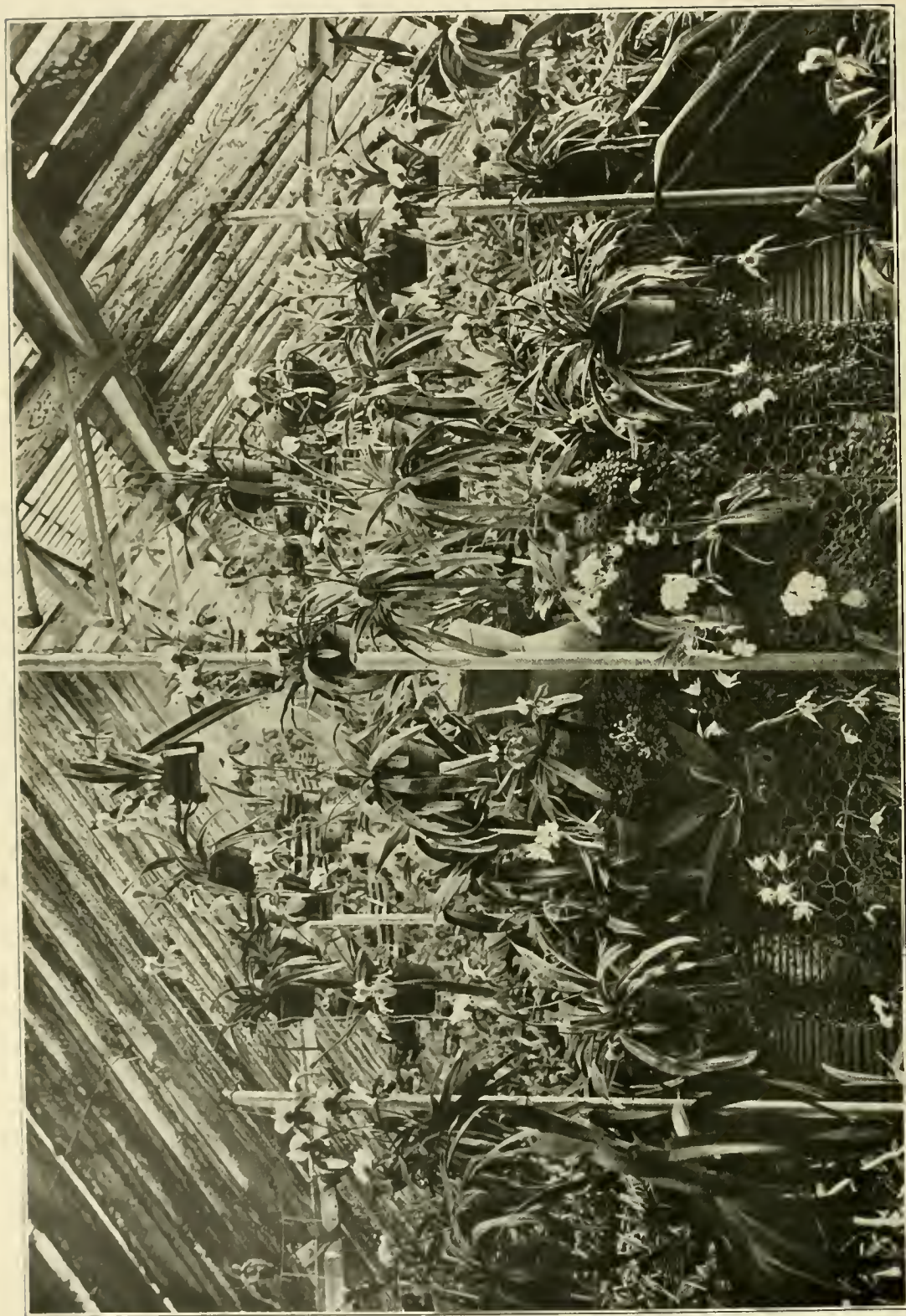
The common or spring vetch (*Vicia sativa*) is very commonly grown as a green-manure crop in southern California. It is planted in September and turned under in February before the trees start the spring growth. The seeds are large and germinate well and the vines suffer less from the trampling incident to harvest than some other green-manure plants. Canada field peas, Tangier peas, bur clover, fenugreek, and sour clover (*Melilotus indica*) are occasionally used in place of the vetch. In northern California, bur clover volunteers satisfactorily and is commonly used. Summer green-manure crops, such as cowpeas, are coming into use wherever there is sufficient cheap water available to supply both the trees and the peas during the dry hot months.

Pruning.

Orange trees are pruned somewhat differently according to the variety. The young Washington Navel tree should not be pruned for the first two or three years after being headed and set in the orchard. Especially if budded from the best type of wood, it may be depended upon to form a good head by itself. Suckers should of course be removed whenever they appear. The Valencia is a more rampant grower, and the young upright shoots are apt to grow too long before branching. They should be pinched back. In pruning old trees, the following rules are thought to embody the best practice: Remove suckers whenever and wherever they appear. Remove the too vigorous vertical shoots which tend to produce coarse fruit. Remove old brush of waning vitality. Thin the tops and, to some extent, the sides so as to allow proper airing and lighting of the interior foliage, thus encouraging the production of high quality, inside fruit. Remove all dead twigs from the fruiting brush. Navel trees rarely need propping, while Valencia trees, unless the limbs are kept short and stout by pinching, are apt to require a great deal of propping.

Harvesting.

California oranges are harvested the year round, the Navels, from November 1 to May 1; seedlings and miscellaneous varieties during May; and the Valentias, from June 1 to November 1, thus overlapping the next Navel crop. A ripe Navel will remain in prime con-



LXXIX. An orchid fancier's house.—Cypripediums, Selenipediums, Miltonias, Laelias, Oncidiums.

dition on the tree for two months, a Valencia for six months or longer.

Oranges are picked with extraordinary care to prevent injury. They are never pulled, but are clipped flush with the "button" with round-pointed clippers. The fruit is collected in canvas bags carried by the picker, which open at the bottom and allow the fruit to slide gently into wooden lug-boxes. The unbroken skin of an orange is very resistant to decay, but the least abrasion, no matter how slight, whether caused by withdrawing the orange carelessly from the branches, or by the finger-nails, or by placing the fruit in boxes in the bottom of which a few grains of sand or dirt have fallen, is almost sure to become inoculated with spores of decay fungi, such as the blue-mold or the soft-rot. Many growers do not take all the fruit from the trees at one picking, but pick the lower fruit first, thus getting it out of the way of frosts which are most severe near the ground; and brown-rot, which is splashed up from the soil by winter rains; and also to relieve the strain on the branches. The standard car is made up of a certain proportion of the different sizes, hence it is customary to go over those remaining on the trees, selecting certain sizes to meet the daily demands at the packing-house. Formerly, picking was paid for by the box, but the tremendous losses from the decay resulting from rapid work has brought about a complete change to day labor.

The lug-boxes of fruit are hauled to the packing-house on spring wagons or auto trucks and weighed in. The fruit is then stored in the same boxes from one to five days, in order that the rind may shrink and the surface cells become less turgid and subject to abrasion. In this condition, oranges will stand a large amount of handling and tumbling about in the padded machines without injury. The fruit is first run through a brusher which removes dust and dirt. In case there is smut from scale insects or soot from oil-pots, they are put through a washing machine containing a $\frac{3}{8}$ of 1 per cent solution of copper sulfate in water. The fruit next travels on belts before the graders who, considering color, shape, smoothness and blemishes, sort the salable fruit into three grades, standard, choice, and fancy. Each one of these grades, after being weighed on automatic scales, passes through a separate sizing machine which delivers each of the eight or ten sizes into a separate, heavily-padded canvas bin. The packers, mostly women, wrap each fruit in printed absorbent tissue paper and place it in the box with great dexterity and skill, averaging sixty boxes a day. A very high pack is customary, and after the covers are forced on and nailed, the boxes are delivered by automatic carriers to the car or the pre-cooling room. One hundred lug-boxes will usually pack out about sixty packed boxes. The cars vary in capacity, depending on whether they are provided with collapsible ice-bunkers. The standard car contains 384 boxes loaded two tiers on end and six rows wide and including not more than 10 per cent of the following sizes, 96, 112, 250, and not over 20 per cent of the 126 size. The remainder of the car may be divided among the 150, 176, 200 and 216 sizes. Cars other than standard are discounted on the market according to the number of the off sizes they contain. The freight is figured on an estimated weight of seventy-two pounds to the box. In summer about five tons of ice are placed in the bunkers after loading and the cars are re-iced in transit as needed, unless they have been pre-cooled, in which case the initial icing suffices. The average time between San Bernardino where the Santa Fe trains are made up, or Colton where the Southern Pacific trains are made up, and New York is about fourteen days. The packing-houses vary in capacity up to twenty carloads a day. In no other fruit industry have the appliances for handling the fruit in the packing-house been so highly developed.

While a few of the larger growers still look after the

sales of their own fruit, and a few sell the fruit on the trees to various fruit companies and commission men, the larger part turn their fruit over to a large and very strong coöperative organization of growers known as the California Fruit-Growers' Exchange. This organization began business in 1895 but was reorganized in 1905. In 1915, the Exchange handled about 62 per cent of all the citrus fruits shipped out of the state. The Exchange has greatly increased the consumption of citrus fruits by advertising and better distribution. The business of the Exchange is to "provide for the marketing of all the citrus fruit of members at the lowest possible cost under uniform methods, and in a manner to secure to each grower the certain marketing of his fruit and the full average price to be obtained in the market for the entire season." Much of the fertilizer and other supplies used in the industry are secured through a coöperative store known as the Growers' Supply Company. In 1914 this store did a business of \$3,319,062.04 at an operating expense to the members of $\frac{3}{4}$ of 1 per cent on each dollar of business transacted.

Varieties.

A large list of varieties of oranges has been tested out under California conditions, but the law of "the survival of the fittest" has worked rapidly and today two varieties dominate the field, viz., the Washington Navel and the Valencia Late. While old orchards of other varieties are still producing considerable quantities of fruit, new plantings are now practically limited to these two varieties. The Washington Navel originated at Bahia, Brazil, in the early part of the nineteenth century and was introduced into California by William Saunders, of the Department of Agriculture, in 1870, through Mrs. L. C. Tibbet, of Riverside. This variety now known as the "king of oranges" rapidly gained in popularity until at the present time nearly 80,000 acres of it are planted. It owes its success to the following characteristics: fruit large, smooth, with fine color and flavor, seedless, a splendid shipper, and having a navel mark which serves on the market as a trade-mark. The tree is semi-dwarf, precocious, prolific, and a regular bearer. The Navel is prone to sport and much care should be used in cutting budwood. The Thomson Improved is the best example of a desirable sport from the Navel. The Navel reaches its highest development in the interior valleys.

The Valencia Late originated in the Azores and was introduced into the United States in 1870 by S. B. Parsons, of Long Island, through Thomas Rivers, of England. The Valencia reaches its highest development along the coast. It is a poorer orange than the Navel, but it is the only variety which remains on the trees in good condition until late fall or early winter. Other varieties still marketed to some extent from old groves are Mediterranean Sweet, Paper Rind, Jaffa, Ruby Blood, and Seedlings.

Insects and diseases.

The following insect pests occur in the California citrus orchards: the black scale, red scale, yellow scale, purple scale, cottony cushion scale, soft brown scale, citricola scale, hemispherical scale, greedy scale, oleander scale, citrus mealy-bug, red-spiders, silver mite, thrips, aphids, orange tortrix, Fuller's rose beetle, and a few others. More than \$500,000 are expended in southern California each year combating the scale insects. The cottony cushion is controlled by a predaceous beetle, but the other scales are controlled by fumigation with hydrocyanic acid gas under movable tents made especially for the purpose. The cost of fumigating a medium-sized tree averages about 35 cents and the work must usually be repeated every second year. Spraying citrus trees for scale insects is almost obsolete in California. The black and purple

scales are most damaging along the coast, while the red and yellow are severe in the interior valleys as well as the coast country. In Tulare County, a species of thrips has done much damage by scarring the fruit and distorting the leaves. The Tortrix worm is the only insect which burrows into the orange.

Gum disease is the most serious fungous disease of the tree in California, while armillaria root-rot, mal-di-gomma, trunk-rot (*Schizophyllum*), twig-blight (*Seelotinia*), wither-tip (*Colletotrichum*), and damp-off fungi are minor troubles. Physiological diseases of the tree include squamosis or scaly bark, exanthema, chlorosis, mottled-leaf, die-back, and leaf-gumming. Fungous diseases of the fruit are: brown-rot (*Pythiacystis citrophthora*), blue-mold (*Penicillium italicum*), green-mold (*Penicillium digitatum*), gray-mold (*Botrytis vulgaris*), sooty-mold (*Meliola Camelliae*), cottony-mold (*Sclerotinia* sp.), gray scurf and navel end-rot (*Alternaria citri*).

Physiological defects of the fruit are: sunburn, frost, off-bloom, exanthema, corrugations, bottle-neck, fingers, yellow-spot, double navel, brown-spot, stem-end spot, cracks, puffs, splits, peteca, red-blotch, and others.

Control measures, more or less satisfactory, have been worked out for the larger number of insects and diseases prevalent in the state.

Protection against frost.

The different kinds of citrus fruits vary in the amount of cold they will endure without injury. The amount of injury done by a given degree of cold upon a given variety will vary, also depending upon the degree of dormancy, the state of the weather just preceding and just after the freeze and the length of time the cold lasts. Many thousand acres of land in California are well suited for growing citrus fruits except for the fact that they are subject to occasional frosts which destroy the crop and sometimes injure the trees. It is natural, therefore, that under such conditions, the citrus growers of California should be pioneers in the work of frost-protection. A great deal of experimenting has been done along the line of diminishing the radiation of heat and by raising the dew-point. It has been demonstrated, however, that the most practicable and satisfactory method of fighting frost is by adding heat directly to the trees through the agency of fires distributed throughout the orchard. Some ten or more types of patent orchard-heaters are now on the market, but the kind the citrus growers find most satisfactory is a round sheet-iron pot of three or five gallons capacity fitted for burning low-grade distillate or crude-oil. The pot should be provided with a suitable cover to keep out the rain and a draught by which the size of the flame may be regulated to suit the degree of cold to be overcome. The less smoke is produced, the better. The smudge commonly used by deciduous fruit-growers is objected to on the ground that the fruit is covered with soot and it is both expensive and damaging to the keeping quality of the fruit to clean it properly. Citrus growers prefer to generate the additional amount of heat necessary to compensate for the lack of smoke.

Many small fires are better than a few large ones. The heaters are usually placed one to each tree or about ninety to the acre throughout the orchard with an extra row along the windward sides. Each ranch should be provided with an oil-reservoir which will hold enough oil to fill all the heaters on the ranch five or six times. When properly equipped with heaters, the temperature of an orchard can be maintained during the night at 10° F. above that of the surrounding country.

The effects of frost on oranges appear as a spotting of the skin and a softening of the outward side of exposed fruits. The juice disappears, leaving the interior dry and pithy. Slightly frosted oranges occa-

sionally develop a very bitter taste. Fruit from the same trees will often grade all the way from sound to badly frosted, depending on the position the fruit occupied on the tree. The method of separating sound from frozen fruit is based on specific gravity.

The machine consists of an oblong tank through which water may be made to circulate at definite speeds by a small propeller. The oranges roll down an incline and drop into the moving water from a height of a foot or more. The light frosted oranges bob up to the surface quickly, while the sound, heavy fruit is slower to rise. Meanwhile the oranges have been carried along by the current, the sound fruit passing under, and being caught by a horizontal wire screen, while the light fruit is carried along above it. At the farther end of the tank the two grades are lifted by conveyors and delivered to separate bins. By adjusting the position of the screen and the rate of flow of the water, any degree of separation desired may be secured.

By-products.

The manufacture of citrus oils, perfumes, citrate of lime, and other by-products has never been developed commercially in California, although at present much experimenting is being done in an effort to encourage such an industry, which is badly needed. At present, the culls mostly go to waste or are applied to the land as fertilizer. The manufacture of marmalade and citrate of lime has been attempted but has not as yet assumed importance.

J. ELIOT COIT.

ORANGE, OSAGE: *Maclura*.

ORANGE ROOT: same as goldenseal, *Hydrastis canadensis*.

ORCHARD. In North America, the word orchard is applied to a plantation of fruit-trees. The orchard is one part of the typical American farmstead, comprising either a few trees for domestic supply in a regularly laid-out plantation or a larger area planted as a source of revenue. Commercial plantings of large extent are also made without particular reference to a homestead. Except in the warmer parts, the apple tree comprises the usual orchard planting. Plantations of bush-fruits are not known as orchards in this country. By custom, orchards of citrus fruits are usually called groves.

ORCHARD-GRASS: *Dactylis glomerata*.

ORCHARD HOUSE, a name frequently used in England for glasshouses devoted to fruit-trees. Consult the article on *Forcing of Fruits*, volume III, page 1260.

ORCHARD PROTECTION: See article on *Frost*.

ORCHIDS. A vast assemblage of herbaceous plants, mostly with unusual and interesting flowers, of which about 15,000 species are at present known. This number is being augmented yearly as the regions which they inhabit become more accessible to collectors. A single collection in New Guinea in 1907 to 1909 brought to light 1,102 new species,—an indication of the number of new forms still to be expected from little-explored regions. Since the first edition of the "Cyclopedia of American Horticulture" was published, the number of known species has been increased by about 5,000. Probably the species now outnumber those of the great family Compositae.

Although widely distributed, the orchids are seldom abundant in any place as to individual plants. They are mostly inhabitants of special or particular places. Orchids are also highly specialized in structure, particularly in character of flowers, in this differing widely from the broadly generalized structure of the Compositae.

These very special plants, with marvelous range of form and color, have naturally excited the greatest

interest on the part of cultivators, and great collections have grown up. To a large extent, these collections have been renewed from fresh importations from the wild, but the recent discoveries of symbiotic relations in germination, as well as better understanding of cultural requirements, will constantly increase the domestic supply. In the culture of a wide range of orchids the gardener exhibits his mastery of the arts of cultivation. The recent studies in this field afford very definite practical applications of scientific methods.

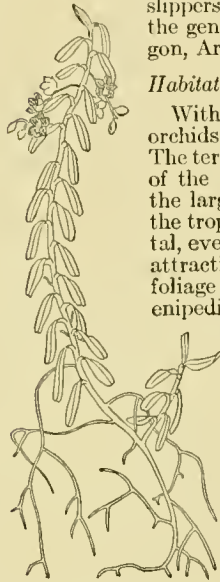
Distribution.

The orchids are distributed over all parts of the world with the exception of the polar regions and the great deserts. About 85 per cent of the species occur in the tropical and subtropical regions. Here they are found to a great extent in the mountainous districts. In some parts of the Himalayan region, the orchids constitute the most abundantly represented family of plants in point of number of species. Most of the tropical species are endemic. The widely distributed species are found in the North Temperate and the Subarctic zones. They include such forms as *Calypso bulbosa* (formerly known as *C. borealis*), *Microstylis monophyllus*, *Liparis Læscii*, and species of *Orchis* (or *Galeorchis*). These are found throughout the northern regions of both hemispheres. The greater number of the orchids are distributed in three regions of the earth: (1) The tropical African region, including the islands to the east, furnishes comparatively few species to cultivation. These mostly belong to the genera *Angraecum*, *Bulbophyllum*, and *Disa*. This region also contains a number of endemic genera not of great interest to cultivators, and representatives of such widely distributed genera as *Habenaria*, *Liparis*, *Microstylis*, *Epipactis*, and others. (2) Unusually rich in genera is the region of tropical Asia, including the neighboring groups of islands. Typical of this region are the large genera *Dendrobium*, *Eria*, and *Bulbophyllum*, and many smaller genera, including *Paphiopedilum*, *Cœlogyne*, *Cymbidium*, *Sarcanthus*, *Saccolabium*, and *Vanda*. Among the genera common to this region and the African region are *Bulbophyllum*, *Phaius*, *Calanthe*, *Liparis*, and *Microstylis*. (3) The tropical American region, embracing Mexico, Central America, tropical South America, and the neighboring islands, occupies an isolated position and consequently contains an unusually large number of endemic genera, many of which are represented by hundreds of species. Besides the large endemic genera *Epidendrum*, *Pleurothallis*, *Oncidium*, and *Odontoglossum*, this region contains many of the commonly cultivated genera, among which may be mentioned *Cattleya*, *Laelia*, *Masdevallia*, *Schomburgkia*, *Brassavola*, *Lycaste*, *Peristeria*, *Stanhopea*, *Gongora*, *Zygopetalum*, *Miltonia*, *Phragmipedium*, and many others. Some genera, among them *Vanilla*, *Bulbophyllum*, *Calanthe*, *Liparis*, and *Microstylis*, are common to both this region and the Old World. Compared with these great floristic regions, the temperate lands of the southern hemisphere are of less importance. Of the south African genera, *Disa* and *Calanthe* furnish a few species valuable to cultivation. Australia contains many genera in common with the tropical Asiatic region, but few of the cultivated species are derived from there. In temperate South America the orchids are sparsely represented by a few species of *Epidendrum*,



2624. Monopodial growth in a vanda.

Oncidium, *Spiranthes*, *Habenaria*, and a few other genera. From a horticultural standpoint, the species of this region are of little importance. About twenty genera are found in the northeastern United States and Canada, mostly in swamps and moist grounds; among them are the *Cypripediums* or lady's slippers, and many beautiful plants in the genera *Habenaria*, *Pogonia*, *Calopogon*, *Arethusa*, and *Calypso*.



2625. Monopodial growth in *Renanthera Cathcartii*.

Habitat.

With regard to their habitat, the orchids are either terrestrial or epiphytic. The terrestrial orchids include the species of the temperate regions and many of the largest and most stately orchids of the tropics. Many of these are ornamental, even when not in flower. A few are attractive on account of their variegated foliage and some, like *Sobralia* and *Selenipedium*, are admired on account of their tall graceful stems.

Most of the terrestrial orchids are green plants which obtain their carbon supply from the carbon dioxide of the air, but a few forms either lack chlorophyll entirely or possess it only in traces too small for normal photosynthesis. These forms are saprophytic in their mode of life and depend for their carbon food upon the organic matter of the humus. The appellation of parasites, which is sometimes given to these forms, is erroneous. True parasites are not known among the orchids.

In the saprophytic orchids, the subterranean part is either a much-knotted coral-like rhizome devoid of true roots (*Corallorhiza*, *Epipogon*), or a subterranean rootstock producing numerous crowded fleshy roots (*Neottia*, *Galeola*). The annual shoots are yellowish, brownish, or reddish, without true leaves, but bearing scales and a terminal inflorescence which may be reduced to a solitary flower. Very curious are the members of the Javan genus *Galeola*, whose leafless climbing stems attain a height of 100 feet, ascending trees by means of roots that arise opposite the scale-leaves, and producing a terminal and many lateral racemes in the upper part of the stem. The saprophytic orchids are not cultivated except occasionally in botanic gardens, as the conditions necessary for their existence are not readily imitated.

The epiphytic orchids exhibit the most varied forms. They are confined to the tropics and subtropics, where they inhabit branches of trees, dead trunks, and often barren rocks in exposed places. They grow mostly in regions where a part of the year is unfavorable to vegetation. As an adaptation to these conditions, they have developed special food reservoirs (pseudobulbs) terminating each season's growth. In this group there are comparatively few plants of attractive habit. They are usually devoid of graceful foliage, each pseudobulb bearing a few stiff leathery leaves. The older pseudobulbs become shriveled and leafless, detracting from the appearance of the plants, and in *Pleione* the plants are entirely leafless at the flowering time. In some of these, however, the pseudobulbs are numerous and closely crowded, and retain their foliage, making plants of neat compact habit (*Cœlogyne*, *Miltonia*). In their mode of life, the epiphytic orchids resemble the green terrestrial orchids. For their mineral nutrients they are dependent upon the material which is mostly the residue of decayed organic matter which accumulates among their roots. They are not saprophytic or parasitic.

Morphology of the vegetative parts.

All orchids are perennial herbs which, according to their mode of growth, fall into two groups—the monopodial and the sympodial.

In the monopodial orchids, the growth of the main stem is continued indefinitely by the terminal bud. (Figs. 2624–2627.) Lateral branches are frequently produced, but they do not regularly assume the part of the main axis and do not under ordinary conditions exceed it in length. The growth of the main stem and its branches may be interrupted for a time by a period of rest, but such interruption is not manifested on the stem by the formation of scales and juvenile leaves when growth is resumed. All leaves are similar. The habit of the monopodial orchids is various. In spite of their indeterminate growth, they do not usually attain great size. This fact is explained by the slow growth of the plants, which often require several months to develop a single leaf. Nevertheless, some of the species attain stately proportions. The climbing species of *Renanthera* sometimes reach a length of 12 feet or more in greenhouses. Some of the *vandas*, *aërides*, and *angræcums* form handsome plants 1 to 2 feet high and well clothed with long distichous leaves. (Figs. 2626, 2627.) While these forms grow into tall leafy plants, others, like *Phalenopsis*, remain almost stemless and possess only a few large fleshy leaves. The extreme reduction is represented by such forms as *Polyrrhiza finalis*, in which the stem is reduced to a mere scaly bud seated on a mass of tangled green roots which perform the function of photosynthesis.

In the sympodial orchids, the growth of each shoot is definitely terminated usually after one, rarely after two or more seasons. The development of the plant is continued by buds originating in the axils of the scale-leaves at the base of the parent shoot. (Figs. 2628, 2629.) The lower part of each new axis is prostrate at first and often subterranean and bears only scales. It is known as the rhizome. In many terrestrial orchids of the temperate regions, the lower terminal part of the rhizome forms a tuberous root from whose apex the

shoot of the next season arises. (Fig. 2630.) In a few sympodial orchids with perennial stems and climbing habits, branches originate in the axils of the stem-leaves (*Vanilla*). These bear a strong resemblance to



2627. *Vanda tricolor*, a branching monopodial orchid.

the monopodial orchids, but all the branches as well as the main stem are finally terminated by inflorescences.

The general habit and appearance of orchid plants depends to a great extent on the nature of the rhizome. When this is long, the plants have a loose straggling habit (*Epidendrum*). When it is short, the plants are compact (*Masdevallia*, *Cattleya*, *Cælogyne*). The rhizome may be much branched and give rise to numerous upright shoots (*Sobralia*, *Cælogyne*, *Disa*), or it may be simple and give rise to only one shoot annually as in many of our native orchids. In some species, the rhizome assumes suberect or climbing habits (*Lycaste*).

The upright part of the axis presents a great diversity of forms which may be grouped in two classes according to the position of the inflorescence. This may be either terminal or lateral.

In the forms with a terminal inflorescence, the leafy part of the stem may be very short so that the leaves appear as a rosette on the ground while the upper part of the stem bears bracts from whose axils the flowers appear (*Goodyera*, *Orchis rotundifolia*, *Cypripedium acaule*), but generally it is more developed and bears a succession of leaves which are gradually reduced to bracts in the upper part (*Habenaria*, *Cypripedium*, *Disa*, *Thunia*). In *Selenipedium* and *Sobralia*, the tall reed-like stems reach a height of 6 to 15 feet and often form dense thickets. In *Vanilla* the stems are long, branched, and climbing. In many of the epiphytic forms the stem is thickened into a pseudobulb. This may consist of a single internode which bears one or two leaves at its summit (*Cælogyne*), but more frequently several internodes are enlarged to form the pseudobulb, which is then clothed with leaves at least when young, and later bears the scars of fallen leaves (*Lælia*, *Cattleya*, *Epidendrum*). Figs. 2631 and 2632 show the two forms of pseudobulb. Sometimes the whole stem is more or less fleshy without



2626. *Angraecum sesquipedale*, to show a monopodial growth.

being enlarged into a distinct pseudobulb (*Epidendrum* spp.).

An equally varied display is presented by the sympodial orchids having a lateral inflorescence. Nearly stemless forms, or forms in which the stem is developed as a subterranean structure often of curious configuration, occur in the Phaiinae (Phaius, Calanthe, Bletia), the Cyrtopodiinae (Lissochilus, Warrea), and the Corallorhizinae (Corallorhiza, Aplectrum). In others, the stem is developed as a pseudobulb consisting of several internodes clothed with leaves (*Cymbidium*, *Mormodes*, *Catasetum*, *Chysis*), or it is elongated and cane-like as in *Dendrobium*, which, however, may belong to the terminal-flowered forms since

some of the near relatives of this genus produce terminal flowers. In species of *Grammatophyllum* and *Cyrtopodium*, the tall leafy pseudobulbous stems attain magnificent proportions, reaching a height of 3 to 15 feet. (Fig. 2633.) In the greater number of the lateral-flowered forms, only a single internode of the stem is enlarged to form a pseudobulb. (Fig. 2634.) Such is the case in *Odontoglossum*, *Oncidium*, *Bulbophyllum*, *Trichopilia*, *Zygopetalum*, *Lycaste*, *Stanhopea*.

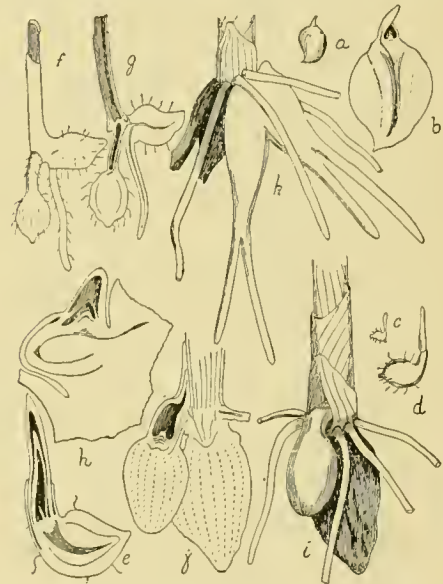
The inflorescence of the orchids is throughout of the indeterminate type, that is, truly terminal flowers are not produced. Even in those cases in which the flower is solitary, the presence of a few bracts above it show its axillary position. In the monopodial orchids, the inflorescence is of necessity always axillary since the growth of the vegetative shoot is indeterminate, but in the sympodial orchids it may be either axillary or terminal, as described above. In *Calogyne cristata*, and a few others, the inflorescence is terminal on special branches of the sympodium.

The form of the inflorescence is various. Solitary flowers occur in many genera, as *Cypripedium*, *Lycaste*, *Anguloa*, and others, but more commonly the inflorescence is racemose or paniculate. The raceme may be close and compact as in some of the monopodial orchids (*Aërides*, *Saccolabium*), or loose with few to many flowers, as in most of our native orchids as well as in most of the commonly cultivated species. In *Renanthera*, the gigantic racemes attain a length of many feet. Large paniculate inflorescences are characteristic of some species of *Oncidium* and related genera. The inflorescences are sometimes of a climbing habit and attain a height of several yards. The large perennial panicles of some species of *Phalenopsis* bear as many as 200 flowers. In *Vanilla*, large racemes arise from the axils of the upper

leaves so that the whole upper part of the plant may be considered as a huge panicle.

Morphology of the floral parts.

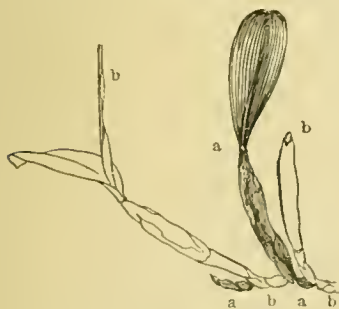
No group of plants exhibits so great variety of modifications of the floral structures as the orchid family. Some of the forms are shown in Figs. 2635, 2636, 2637. Fundamentally the flower is of the liliaceous type; but, by the suppression of some parts and the modification of others, the structure of the flower has been so changed that in its outward appearance it bears little resemblance to the typical monocotyledonous flower. In flowers of the liliaceous type, there are normally present two outer whorls of floral organs, the sepals and the petals, two whorls of stamens, and an inner whorl representing three carpels. In the orchid flower, the two outer whorls, the sepals, and petals are developed. Of the stamens, only two are fertile in the *Diandrae* (*Cypripedium* and related genera), while in all the other orchids (*Monandreae*) only a single stamen is fertile. The three carpels are always present. The three corresponding stigmas are developed in the *Diandrae*,



2630. The tuber formation of terrestrial sympodial orchids, *a, b, c, d*, young seedling stages of *Orchis militaris*; *e*, section through the same; *f* and *g*, plants the following spring with the tubers completed; *h*, section showing beginning of lateral shoot; *i*, tubers of mature plant; *j*, longitudinal section of same; *k*, tubers of *Orchis latifolia*.

while in most of the remaining orchids only two stigmas are receptive (*Monandreae*). (See Fig. 2638.)

The relation of the parts of the flower to one another is greatly changed by the growth of the floral axis. This is convex in the very young stages of development but it soon becomes cuplike by the cessation of growth of the center and the more rapid growth of the peripheral zone. A hollow or tubular axis is thus produced, within which are formed three longitudinal ridges or placenta upon which the ovules are borne. The hollow floral axis constitutes the "inferior ovary" of the orchids (Fig. 2639) and at the same time acts as the stalk or pedicel of the individual flowers of the inflorescence. The ovary is structurally 3-celled. (Fig. 2640.) Besides the carpellary cavity, the axis of many orchids contains another cavity which lies toward the labellum or lip and opens at the base of it. This is a nectary. It may be considered in the nature of the cavity of an adnate spur of the labellum. In the embryonic state, the orchid flower is so oriented that



2629. *Cattleya*, showing a sympodial growth. The light and shaded parts, *a, a* and *b, b*, each represent one year's growth.

the labellum is situated on the side of the flower toward the axis of the inflorescence, as shown in Fig. 2638; that is, it points toward the apex of the inflorescence. In a few forms this condition is permanent, but in the greater number of orchids the ovary or axis is vari-



2631. *Cattleya dolosa*, a sympodial orchid with terminal inflorescence and pseudobulbs consisting of several internodes.

ously bent or twisted so that in the mature flower the labellum is on the side of the flower away from the floral axis or, generally speaking, on the lower side of the flower.

Of all the floral organs the sepals are the least modified. These comprise the outside whorl in Fig. 2638. The one originally opposite the axis of the inflorescence, but which by reason of the turning of the flower just described usually occupies a position adjacent to the axis or on the upper side of the flower, is known as the odd sepal. By reason of its actual position with reference to the flower, it is sometimes called the upper sepal. The other two, which were originally adjacent to the axis of the inflorescence, are the paired or lateral sepals. In most orchids, the lateral sepals are asymmetrical, but noteworthy modifications occur only in a few genera. Sometimes the lateral sepals are partly or entirely united (Cypripedium, Oncidium). In Masdevallia, all the sepals are united into a short tube at the base, and expand above into three blades terminating in long tails. Occasionally, the odd sepal is spurred or saccate (Disa) and very commonly differences in size exist between it and the lateral sepals.

Of the members of the second whorl, the two lateral ones are usually petal-like while the one opposite the odd sepal is specially modified, and is known as the labellum (l, in Fig. 2638). In most genera the lateral petals resemble the odd sepal, although minor differences in form, size, and color are of frequent occurrence. This resemblance is most striking when these parts have some unusual form, as in *Oncidium Papilio*, in which they resemble the antennae of an insect, or in *Phragmopedium cauda-*



2632. *Coelogyne Cumingii*, a sympodial orchid with terminal inflorescence and pseudobulbs of one internode.

tum, in which they are longcaudate, attaining a length of 3 feet. In some genera, the lateral petals show no resemblance to the odd sepal (Huttonia, Masdevallia, Achrochaene). Asymmetry of the lateral petals occurs very frequently.

The odd petal, or the labellum, presents the greatest diversity of form of all the floral organs. Sometimes it is small and inconspicuous (Disa), or it is like the lateral petals (Goodyera). As a rule, however, it is much larger than the lateral petals (as in Fig. 2637), and often it is the most conspicuous part of the flower (Oncidium, Cypripedium, *Odontoglossum Lundesboroughianum*). In a few genera the labellum is bifid (Vanda, Listera), but in the greater number of orchids it is evidently three-

lobed. One of the most common forms which the labellum assumes is that of a trumpet-shaped tube whose sides are formed by the lateral lobes, while the middle lobe is expanded into a variously shaped blade which is often of a deeper shade than the rest of the flower and orna-

mented by crests and ridges and color-markings of various kinds which are thought to be of service to the flower by attracting insects and guiding them to the nectar and hence to the pollen and stigmas. This form of labellum is characteristic of many of the most beautiful orchids in cultivation (Cattleya, Laelia, Dendrobium, Phaius). Frequently the labellum is more or less concave, and in Cypripedium and related genera it has the form of a sac (Fig. 2636) often compared to a shoe as the name "lady's slipper" indicates. In many species, the labellum is strangely transformed and more or less distinctly segmented into a basal part, the "hypochil," and a terminal

petaloid portion which is then designated as the "epichil." Sometimes the differentiation is carried still further and an obscurely defined section, the "mesochil," is recognized between these two. The hypochil is the stalklike, or somewhat concave winged part which joins the column. It is not clearly distinguishable from the foot of the column described below. The mesochil is usually provided with two lateral cirrhous appendages termed "pleuridia," and a central callus known as the "mesidium" (Phalaenopsis, Stanhopea, Peristeria, Gongora). (Fig. 2641.) The epichil is the simple or lobed terminal part of the labellum. In color and consistency it usu-



2633. *Grammatophyllum speciosum*, a sympodial orchid with lateral inflorescence and pseudobulbous stems consisting of several internodes and attaining a height of several feet.

ally resembles the lateral petals. Often it is movably attached to the mesochil. In some forms of the Pterostylidinae the labellum is sensitive, and when irritated by an alighting insect closes sharply against the column, entrapping the animal.



2634. *Odontoglossum Cærstedii*, a symphyllid orchid with lateral inflorescence, and pseudobulbs consisting of a single internode.

The morphological center of the flower is occupied by a fleshy elongation of the floral axis known as the column. This is short and inconspicuous in some forms, but in most species it is well developed. It is usually bilaterally symmetrical. The posterior surface is convex while the anterior surface, toward the labellum, is concave. Usually the column is curved toward this face. In a few forms, like *Cynoches*, the curvature is very marked, while in *Coryanthes* the column is asymmetrically bent. Within the column is a canal continuous with the carpellary cavity. (Fig. 2642.) The column is primarily of importance because at its upper

end it bears the stamens and the stigmas and auxiliary structures which function in the pollination of the flowers. Besides these organs, it sometimes bears a number of outgrowths and appendages which give it a very complex appearance. Often the labellum does not appear to be attached directly to the column, but is borne upon a special fleshy outgrowth at its base known as the "foot" of the column. Between the forms in which the foot of the column is not developed and those in which it is present, no distinct line can be drawn. In our native orchids it is mostly absent. In *Grammatophyllum* there is a small cuplike depression upon whose anterior wall the blade of the labellum is attached with a narrow base. It is here a matter of interpretation whether the anterior wall of the cup is regarded as a part of the labellum or as the foot of the column. (Fig. 2643.) In other cases where the foot is more distinctly developed, the labellum is often plainly attached to its



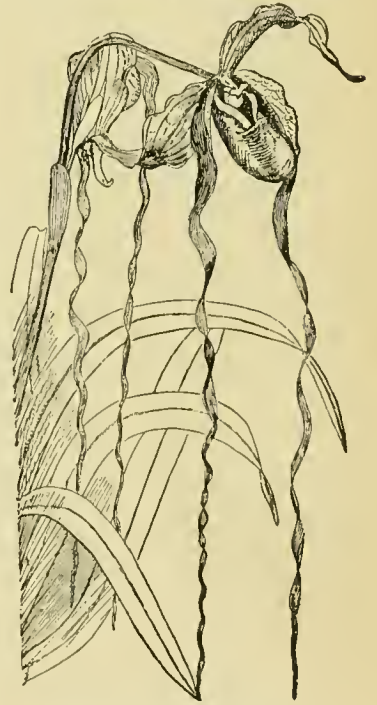
2635. An orchid flower (with unexpanded bud above), to show the very long spur. — *Macroplectrum sesquipedale*. ($\times$ about $\frac{1}{4}$)

lower side, as in *Paphinia*, *Pescatoria*, *Phaius*, *Bulbophyllum*. (Fig. 2644.) Frequently the lateral sepals are decurrent upon the foot or entirely attached to it (*Bulbophyllum Achrochaene*, Fig. 2645). In some forms the lateral sepals and the labellum are borne near the end of the foot while the lateral petals are decurrent upon it (*Batemannia*). Sometimes the lateral sepals and the labellum are carried entirely away from the other parts by the elongation of the foot of the column, thus giving the flowers strange and fantastic forms (*Drymoda*, *Gongora*, *Aërides*). When the lateral sepals or the petals are decurrent upon the foot they, together with the labellum attached at the apex, often form a "chin" or "mentum" which is present in many orchids, such as *Dendrobium*, *Pescatoria*, *Lyeaste*, *Batemannia*. (Fig. 2646.) Frequently the base of the mentum is extended below into a sac or spur of various forms and length. More often the spur arises from the labellum itself (*Phaius*, *Platanthera*). Within the cavity of these spurs or sacs, honey is secreted, and often the walls themselves contain juices which are sought by insects.

The upper part of the column bears the stigmas and the stamens. In the *Diandrae*, the three pistils are fertile, as indicated by the more or less evidently three-lobed stigma (Figs. 2647 and 2648), but in the *Monandrae* only two stigmas are receptive. The place of the third is occupied by the curious "rostellum," which separates the anther-bed from the stigmas and prevents the pollen from falling directly upon them (Fig. 2642). The stigmas are usually flat surfaces sunk in a depression in the column below the rostellum. In a few genera they are elevated on stalks (*Habenaria*), and in *Sophranitis* they extend partly along two wing-like projections of the column. The essential organs, in other forms, are shown in Figs. 2647-2652.

The stamens in the *Diandrae* are situated laterally on the column under a shield-like staminodium which is developed in place of the odd stamen of the outer whorl. In the *Monandrae*, the stamen is situated at the dorsal margin of the column. Its position is sometimes erect, but more frequently it is bent downward with the anther either pendent (*Cælogyne*, Fig. 2650), or lying in a depression, the "clinandrum" or "anther-bed," in the top of the column. From the dorsal part of the column a petaloid appendage often arises and extends above the anther. The sides of the anther-bed are formed by outgrowths of the column. They are often developed as erections, ears, or winglike structures ornamenting the column and enfolding the anther. The floor of the anther-bed is formed by the rostellum.

The anther sometimes remains two-celled, but more frequently the cells are further divided, by longitudinal



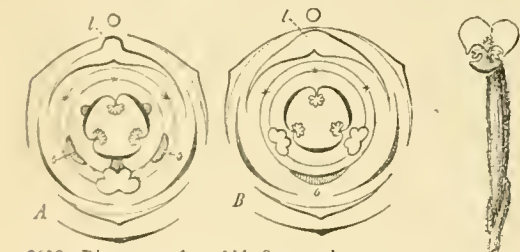
2636. The appendaged flower of *Phragmopedium caudatum*.

partitions or cross-walls, into four or eight cells. In a few cases, six cells are formed, probably by the abortion of some of the cells.

The pollen is powdery in some cases, but usually the grains are united by means of a viscid substance into waxy masses termed "pollinia." The number of pollinia corresponds to the number of anther-cells. In many genera, the viscid substance uniting the pollen-grains is prolonged beyond the pollen-mass and hardens into a stalk or "caudicle" within the anther-cell (Fig. 2651). One or two pollen-masses are attached to each caudicle. When the anther dehisces, the caudicles come into contact with masses of sticky matter formed by the disorganization of cells on the upper surface of the rostellum. In many orchids, this substance itself forms the adhesive disk by means of which the pollinia become attached to insects. In others a strip of tissue is separated from the rostellum by the disorganization of the underlying cells, and forms a stalk which in this case is known

as the "stipe." When a stipe is formed by the rostellum, the caudicle of the pollen-masses is not produced. In that case, the pollinia become directly attached to the stipe when the anther dehisces. The other end of the stipe forms the adhesive disk. (Fig. 2652.) Whatever its origin, the stalk with its adhesive disk is one of the most important parts of the mechanism by which the transport of the pollen-masses from flower to flower is brought about and by means of which cross-pollination is insured. The details of the process by

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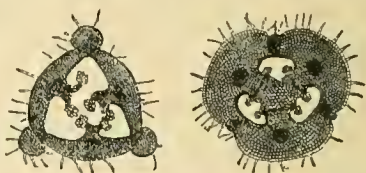


2638. Diagrams of orchid flowers in cross-section.—A, *Monandrea* (one-anther) and B, *Diandrea* (two-anthers); l, represents the labelum, and oo (in the inside of the diagram) the staminodia.

which this is accomplished have been beautifully explained by Darwin in his classical work, "The Various Contrivances by Which Orchids are Fertilized by Insects."

Dimorphic and trimorphic flowers occur in a few orchids. In the inflorescences of a small group of *Oncidiiums* (*Heterantha*), only few normal flowers are produced together with many smaller sterile ones which lack the column. In *Renanthera Laxii* the upper flowers of the long inflorescence differ in form and color from the others. The most unusual condition exists in *Catasetum*, in which there are three very different types of flowers. In some years the same plant produces only one type and in other years all types on a single inflorescence.

The flowers of orchids are commonly noted for their longevity. When not pollinated, the flowers of most genera remain fresh for thirty to forty days, and in some genera even for much longer periods. Only a small number of genera have flowers that wither in a few days (*Sobralia*, *Cirrhopetalum*). The persistence of the flowers greatly increases the chances for pollination, which, since it is dependent on particular agencies, is more or less uncertain. After pollination has been effected, the flowers soon wither.



2640. Orchid ovaries in cross-section.—*Paphiopedilum Charlesworthii* at left; *P. Schlimmii* at right.

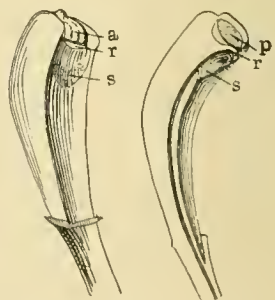
The fruit of orchids is usually a dry capsule, requiring a long time to ripen, so that if an orchid flower is fertilized in one rainy season its seeds are not disseminated until the next wet period. Very few have fleshy fruits which dehisce imperfectly or not at all. In them the seeds are liberated only by the decay of the pericarp (*Vanilla*). The seeds of orchids are minute and extremely numerous, the number in a single capsule having been estimated for different species from several thousands to over a million. The seeds consist of a dry loose large-celled testa enclosing a rudimentary embryo, which in most genera is entirely undifferentiated. (Fig. 2653.)

Symbiosis.

So far as known, the roots of all orchids, with the exception of occasional individuals, are inhabited by fungi which live within the tissues either symbiotically or at least without causing any apparent injury to the plant. The fungus hyphae are primarily found in the cortical tissues, but usually two or three of the outer layers of cells of the cortex are not infected. In the epidermis the fungus is found only in the cells bearing root-hairs, through which

long hyphae pass out into the substratum. The central cylinder and the growing apex of the root are not infected. The extent to which the fungus passes upward

in the plant varies with different species and with the condition of the roots. In *Neottia*, *Goodyera*, and *Corallorhiza* the lower part of the stem is invaded sometimes up to the first node. In *Epipactis*, *Cypripedium*, and *Listera*, the roots and rhizomes contain much woody tissue. In such forms, many of the roots are free from fungi, and in the remaining roots, as well as in the rhizomes, the distribution of the fungus is irregular. The basal parts of the roots, which are more or



2642. Column of a cattleya, with a longitudinal section at the right.—a, anther; r, rostellum; s, stigma; p, pollinium.

2641. *Stanhopea platyceras*. A, complete flower. B, section. ls, lateral sepals; os, odd sepal; lp, lateral petal; h to op, odd petal or labellum of which h is the hypochil, m the mesochil, and op the epichil, ms, mesidium, and x, pleuridia.

2639. Orchid flower, showing the long stem-like ovary between the two bracts and the other floral parts above.

less woody, are not infected; and occasionally individual plants are found which appear to be free from the fungus. In the roots of epiphytic orchids, also, the distribution of the fungi is irregular, only scattered islands of cortical tissue being as a rule infected. Only



2643.

Flower of *Grammatophyllum speciosum*, showing at the base of a column a cuplike depression to the anterior wall of which is attached the labellum, with a narrow claw.

the parts of the roots which are in contact with the substratum contain fungi. In forms like *Vanda* and *Vanilla*, with superficial roots, only the side of the root adjacent to the substratum is infected, while the other chlorophyll-bearing side is free.

Within the cells, the fungus has the form of closely coiled and interwoven masses of hyphae, except in the root-hairs and in the velamen,—the spongy outside covering of the roots of epiphytic orchids,—where long hyphae occur. The endophytic mycelium is, as a rule, connected with external mycelium in the substratum by means of hyphae passing through the root-hairs, or, where these are absent, as in *Neottia Nidus-avis*, through the epidermal cells of the rhizome and the roots. In some forms, like *Neottia* and the epiphytic orchids, such communications have been only sparingly observed, while *Corallorhiza* and most of the terrestrial orchids have abundant connections with the mycelium in the substratum.

The plants are sometimes permanently infected through the seedling in the way described farther on. Infection also takes place through the root-hairs. When the rhizome and the upper part of the roots are free from fungi, infection must of necessity take place in this way. In epiphytic orchids, and probably in terrestrial orchids also, repeated infections thus occur. In some terrestrial orchids, in which the fungus invades the rhizome, the hyphae grow out directly from this into the new roots, and also into the bud for the following year. In such forms only a single infection is necessary to establish a permanent symbiosis.

It is generally held that the mycorrhiza fungi supply their hosts with nutrients. That the non-green forms like *corallorhiza* are supplied with organic carbon compounds in this way can scarcely be doubted, for these plants, lacking chlorophyll, cannot elaborate their own carbohydrates from the carbon dioxide of the air. It is certain, also, as will be described later, that the germination of orchid seeds and the early stages of development of the seedling do not take place without the intervention of the mycorrhiza fungi, but the function of the fungi in these processes remains still to be investigated.

To what extent the mycorrhiza fungi function in supplying the plants with water, salts, and organic nitrogenous compounds, is not known. For the greater number of orchids that are equipped with chlorophyll and which can, therefore, utilize the carbon dioxide of the air for the production of carbo-

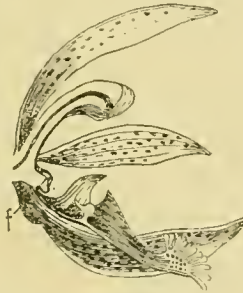
hydrates, it is not likely that the root-fungi are necessary for supplying them with carbon compounds. There is some evidence, however, that the fungi have a part in supplying the plants with nitrogenous compounds and possibly with phosphorus and potassium also. The fact that the hyphal coils are finally digested in the cells and that the substances which they contain thus become available to the plant, throws no light on this problem for the substances in the hyphae may have been derived from the plant itself. Investigations up to the present time have shown that orchids do not assimilate free nitrogen from air by the aid of their endophytic symbionts, nor do the fungi themselves in pure cultures fix free atmospheric nitrogen.

Seedlings.

The growing of orchid seedlings has always been surrounded with much mystery and secrecy. In the large orchid establishments, the secret methods which the expert growers were supposed to possess were carefully protected by locked doors and painted glass, and visitors were seldom admitted to the houses. Yet it was evident that in spite of the carefully guarded practices, chance seemed to play an important part in the culture of orchid seedlings. Rarely were the expert growers uniformly successful. Of the vast number of genera imported, only *Cattleyas*, *odontoglossums*, *Cypripediums* and a few others could be grown with even a fair assurance of regular success. Some growers were unusually successful with one group and some with another, but generally all were not equally successful with all kinds. The key to this situation was furnished by Noel Bernard who, in 1903, attempted to grow seedlings of a hybrid between *Cattleya Mossiae* and *Lalia purpurata* under aseptic conditions and found that the embryos swelled and formed green spherules, but that they failed to develop further even after weeks, and finally died. If, however, the seeds were sown on pure cultures of the endophytic fungus isolated from the roots of these plants, the embryo developed normally, forming a spheroid body which soon produced a cotyledon and papillae with long root-hairs. Further investigations, chiefly by Bernard and by Burgeff,



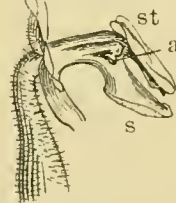
2646. The mentum.—*a*, spur-like mentum of *Lycaste Cobbiana*; *b*, sack-like mentum of *Acanthophippium javanicum*; *c*, chin-like mentum of *Batemannia Colleyi*.



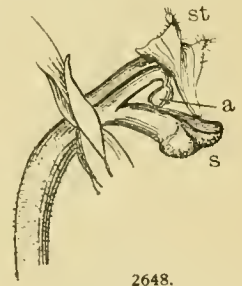
2644. *Paphinia cristata*, showing at *f* the foot of the column with labellum attached on lower side.



2645. *Bulbophyllum Achrochane*, showing (*s*, *s*) lateral sepals decurrent on foot of column.



2647. *Cypripedium*.—*st*, staminodium; *a*, anther; *s*, stigma.



2648. *Phragmopedium caudatum*.—*st*, staminodium; *a*, anther; *s*, three-lobed stigma.

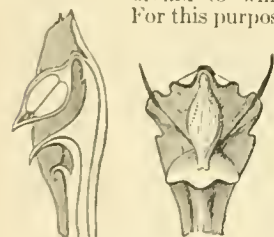
showed that the germination of orchid seeds does not occur except in the presence of the root fungi. Even seedlings of such little mycotrophic forms as *Cypripedium* and *Epipactis*, will not develop unless infected, although the mature plants of these species are often found without fungi and do not require their presence.

The infection of the orchid embryo takes place through the suspensor by means of which the embryo was attached to the nutrient tissue of the ovule (Fig. 2654). From the suspensor the fungus invades the cells in the lower region of the embryo, except the epidermis. The cells become filled with dense interwoven gnarles of hypha-like those in the roots. The coils in the inner cells undergo a process of digestion, but those in the outer cells remain intact and send hyphae through the root-hairs of the papillae into the soil. New papillae with long absorbing hairs are soon developed and the cotyledon and leaves begin to be differentiated. After three to four months, roots are produced and the young embryo begins to assume the characteristic form of an orchid seedling (Fig. 2655).



2649. Structure of the column of *Paphiopedilum Dormanianum*.—*a*, anthers; *b*, body representing the third stamen; *c*, stigma. Underneath are the remains of the floral envelopes, which have been torn away.

brought about. In practice, this has often been accomplished by the sowing of the seeds on pots containing the parent plants. This method, however, has many disadvantages. The plants cannot be repotted while the seedlings are growing, and the seeds are likely to be washed away in watering, since they cannot be readily protected by a proper covering. Better success can be secured by the use of straight-walled glass jars with loose glass covers. These are filled with finely chopped sphagnum, which is well pressed into the jar. The whole is then sterilized in a steam-box for one hour on three successive days in order to kill bacteria and spores of molds which are likely to overrun the seedlings. After sterilization, the jars should be allowed to stand for a few days. Those in which molds develop should be discarded. The sterile jars may then be inoculated with the root-fungus from the species of orchid to which the seed-plant belongs.



2650. The pendulous anther in *Celycyne speciosa*.

from $\frac{1}{2}$ to 1 inch back from the root-tip are most abundantly infected. As soon as the root-fungus has grown through the sphagnum, the seeds should be sown in the jars. In the collection and handling of the seeds, all possible precaution should be taken to prevent contamination.

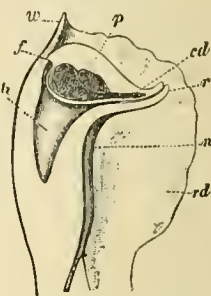
While the difficulties involved in these manipulations are considerable, they are not insurmountable, and it is not unlikely that in time means will be found to remove many of the uncertainties which at present attach to the growing of orchid seedlings. With the increasing demand for orchids for cut-flowers and for general florists' use, and the depletion of the sources of supply of imported orchids,—especially of the rarer endemic varieties,—the growing of seedlings will become more and more a matter of necessity. The production of new and improved varieties, and the preser-

vation and multiplication of rare sorts will be greatly facilitated when the growing of seedlings is freed from its many uncertainties. The seed-grown plants have many advantages over the imported ones. They are from the start better adapted to greenhouse conditions. They are harder and more resistant and can be grown into plants of better form. They also flower more freely and often can be made to bloom twice a year.

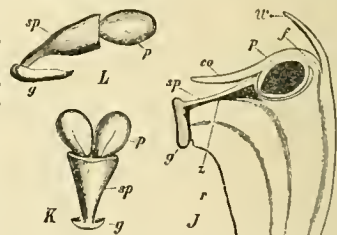
Hybrids.

One of the most fascinating phases of orchid-culture is the production of hybrids. By the crossing of different genera and species, numerous new orchids have been produced, many of which are superior to the native species. The first orchid hybrid to be produced in cultivation was *Calanthe Dominii*, a cross between *C. masuca* and *C. furcata*. It was raised by Mr. Dominy in the nursery of James Veitch & Son, and flowered in 1856. Other hybrids, including the beautiful *Calanthe Veitchii*, appeared in the following years, and in 1861 the same grower produced the first bigeneric hybrid, *Goodyera Dominii*, which was a cross between *Hæmaria* (*Goodyera*) *discolor* and *Dossinia marmorata*. Since that time the interest in orchid hybridization has grown greatly. The number of orchid hybrids now is between 3,000 and 4,000. Rolfe and Hurst record twenty-three genera which have entered into bigeneric hybrids, and many cases in which three genera have entered into the hybrid. In some hybrid genera, like *Laeliocattleya*, the forms far outnumber the species of the parent genera.

The pollination of orchid flowers requires a little skill and patience and a knowledge of the parts of the flowers described earlier in this article, but otherwise offers no great difficulties. Only strong and vigorous plants should be chosen for seed-bearing, since the process greatly exhausts the plant and sometimes even causes its death. The pollinia are mature and the stigmas are receptive when the flower is fully open. When it is the purpose to produce hybrids, it is well to remove the pollinia of the plant that is to bear the seed since the possibility of accidental interference by the plant's own pollen is thus prevented. Even when it is intended merely to grow non-hybrid seed, this course is to be recommended, since, in nature, the orchids are habitually cross-pollinated. The pollination is easily accomplished. To this end, the pollen-masses are removed from the anther by means of a sharp lead-pencil or a pointed stick and placed on the stigmatic surface. In the *Cypripedium*s and related genera, the pollen-masses are exposed, but in most of the other orchids the pollen is covered by the anther, which can be readily removed. The pollinia can be picked up by



2651. Column of *Phaius cupreus*.—*h*, cavity below the anther; *f*, filament; *p*, pollinia; *cd*, caudicle; *r*, rostellum; *n*, stigma; *w*, petaloid extension of the dorsal part of the column continuous with the lateral wings, *rd*.



2652. *J*, column of *Cochlidia sanguinea*; *w*, dorsal extension of column; *f*, filament; *p*, pollinium; *co*, extension of filament; *sp*, stipe; *g*, adhesive disc; *z*, disorganizing tissue by means of which the stipe and adhesive disc are separated from the rostellum. *K*, two pollinia with stipe and adhesive disc; *L*, lateral view of same.

touching the adhesive disk with the stick or lead-pencil. Usually several pollen-masses will be thus withdrawn, but as a rule it is best to place only a single one upon each stigma. Fewer seeds are thus ripened but these are better nourished and produce more vigorous seedlings than seeds from full capsules. The methods of sowing the seed are the same as already described.

The nomenclature that has been most frequently adopted (aside from treating them as direct species names) for simple orchid hybrids between two species of the same genus consists in the application to the hybrid of a Latin name of specific rank but preceded by a $\times$. Thus *Calanthe* $\times$ *Vitchii* signifies that the plant so named is a hybrid between two species of *Calanthe*. Sometimes non-latinized names are used, as *Cattleya* $\times$ "Nymph." In the case of bigeneric or trigeneric hybrids, the name of the hybrid is usually formed by the combination of parts of the names of the parents or of the whole name of one parent and part of that of the other, as *Epiphronitis* (*Epidendrum* and *Sophrontitis*), *Laeliocattleya* (*Laelia* and *Cattleya*), *Brassocattleya* (*Brassavola*, *Cattleya*, and *Laelia*).

These are written as one word without hyphens or capitals at the beginning of the second or third parts. For further details concerning orchid hybrids and lists of all known forms, see G. Hansen, "The Orchid Hybrids," London, 1895; E. Bohnhof, "Dictionnaire des Orchidées Hybrides," Paris, 1895; R. A. Rolfe and C. C. Hurst, "The Orchid Stud-book," Kew, 1909, and Sander & Sons, "Orchid Hybrids," St. Albans, 1912 (?).

For other sug-

gestions on the nomenclature of orchid hybrids, see the entries *Adamara*, *Linneara*, *Lowiara*.

Foliage plants.

The *Physuræ*, a small group of orchids distributed in tropical Asia and the Malay Islands, with a few species in Africa and North America, are remarkable for their beautifully variegated leaves (*Physurus*, *Anæctochilus*). The plants themselves are usually small, with the habit of *Goodyera*, a North American representative of the group. Variegated or mottled leaves occur also in some other groups (*Cypripedium*, *Goodyera*, *Phalænopsis*, and *Oncidium*).

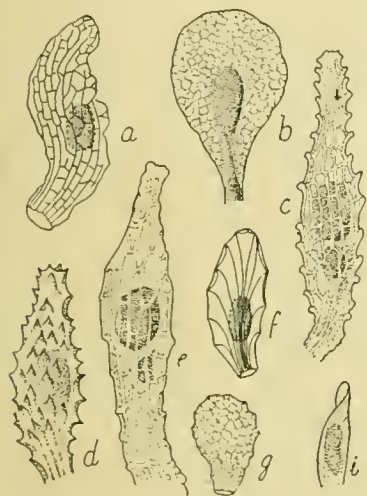
Historical sketch.

While the native orchids of Europe excited the interest of the herbalists of the sixteenth century, the epiphytic forms of the tropics did not become known to botanists until a much later period. By the end of the seventeenth century, a few species had been described and figured by Rheede tot Draakenstein, Sloane, Plumier, and others. In the second edition of Linnaeus' "Species Plantarum" (1763), thirty species of epiphytic orchids are described under *Epidendrum*, which, at

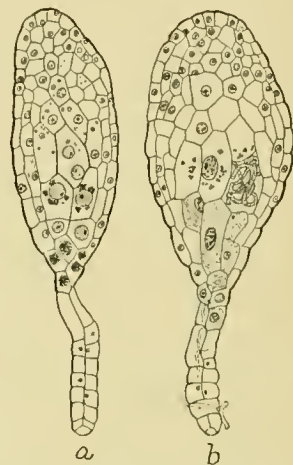
that time, was made to include all epiphytic orchids from the tropics. In 1805, Willdenow, in his edition of the "Species Plantarum," listed 391 orchids, including 140 epiphytic species. In the nineteenth century, through the exertions of many collectors, the number of known tropical orchids rose rapidly. For the descriptions of the numerous forms coming in during that time we are chiefly indebted to efforts of Lindley and of Reichenbach.

Attempts at the cultivation of tropical orchids apparently did not begin until early in the eighteenth century. The first edition of Miller's "Gardener's Dictionary," in 1731, describes twenty native European species under *Orchis*, but no tropical form is mentioned. About this time, however, plants began to be introduced into English conservatories by missionaries and officers who visited the tropics. In 1731, *Bletia verecunda* was received from the West Indies. The vanilla was cultivated by Miller in 1759, and was at that time fairly well known in English conservatories. In 1789, Commodore Gardner sent plants of *Epidendrum fragrans* from the woods of Jamaica. One of these flowered two years later and was the first orchid figured in Curtis' "Botanical Magazine," plate 152 (as *E. cochleatum*). In Martyn's edition (1807) of Miller's "Gardener's Dictionary," 124 orchids, including the vanilla, were listed under *Epidendrum*.

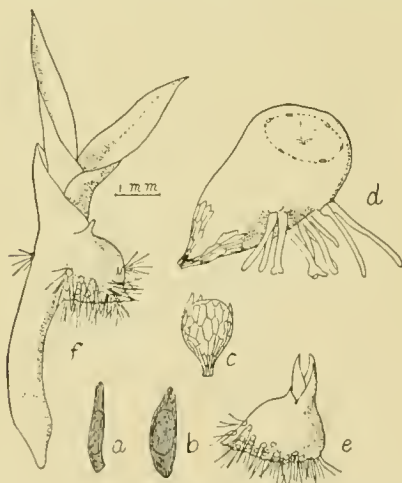
The middle part of the nineteenth century is remarkable for the great number of new and rare forms intro-



2653. Seeds of orchids.—a, *Listera ovata*; b, *Stanhopea Warscewiczii*; c, *Mormodes Buccinator*; d, *M. viridiflora*; e, *M. pardina* var. *unicolor*; f, *Orchis secundiflora*; g, *Sturnia Lœselii*; i, *Octomeria lancifolia*.



2654. Embryos of a *Laeliocattleya*. a, not infected; b, infected.



2655. Seedling of *Odontoglossum*.—a, seed; b, same somewhat swollen; c, same bursting testa; d, young spherule with root-hairs; e, more advanced stage showing cotyledon and first leaves; f, seedling with root and leaves developed.

duced, and for the large sums often paid for striking novelties. As early as 1855, a plant of *Aerides Schroederi* brought something over \$430 (G.C. 1855, page 775). In 1875, a plant of *Dendrobium Wardianum* was sold at Stevens' auction rooms for over \$500 (G.C. 1875,

I, page 502), and in the same year at the sale of the collection of John Russell at Mayfield a plant of *Saccolabium guttatum* sold for \$313, one of *Saccolabium Russellianum* for \$141, and an *Oncidium splendidum* for about \$150 (G.C. 1875, II, page 467). In 1879, a fine plant of *Vanda carulea* sold among other orchids of a large collection for about \$460 (G.C. 1879, I, page 27). These are only instances with which the records of that period are replete. Although such prices were realized only for exceptional plants, there was always a large demand for good plants of all types, for which considerable sums were paid. The prospects of great reward caused collectors to scour every part of the tropics, risking their lives in the mountains, jungles, and fever-haunted swamps. Vast numbers of plants were imported and many died on the voyages, or subsequently, for want of rational treatment; but the large importations served to popularize the plants and to increase the demand for them. In time the climatic conditions under which they grew in their native regions became better known, and the plants were treated more in accordance with their requirements. Fewer orchids are imported at the present time, for the rewards are not so great as formerly, and other means for multiplying the stock are supplanting importation to a great extent. Yet the interest in orchids is not abating, but is steadily becoming more widespread. Although the large collections of fanciers are not so distinctive of orchid-culture as formerly in this country, the use of the plants is becoming far more general. The flowers have become a regular part of the florist's stock and thousands are annually sold in the markets. The ease with which they are grown, their great range of fine colors, and the wonderful keeping qualities of the flowers insures them an ever-increasing popularity.

Literature.

A large and special literature on orchids has grown up. Many magnificent folios and smaller works have been devoted to the illustration and description of these plants. Notable among these are "Sertum Orchidaceum," by J. Lindley, London, 1838, a large folio containing forty-nine colored plates of East Indian orchids; "The Orchidaceae of Mexico and Guatemala," by J. Bateman, London, 1837-1843, an even more sumptuous work, with forty plates, of which only 125 copies were published; "A Monograph of Odontoglossum," London, 1864-1870, by the same author; "Pescatorea," Brussels, 1860, by J. J. Linden; "Reichenbachia," St. Albans and New York, 1888-1890, second series 1892-1894, by F. Sander, folio, two volumes, with ninety-six colored plates; "A Century of Orchidaceous Plants," London, 1849, by W. J. Hooker, a quarto volume containing 100 plates selected from Curtis' "Botanical Magazine," "A Second Century of Orchidaceous Plants," London, 1867, by J. Bateman, contains 100 plates of reproductions from the same work; "Xenia Orchidacea," Leipzig, 1858-1900, by H. G. Reichenbach, three quarto volumes containing 300 partly colored plates; "The Orchid Album," London, 1882-1897, by Robert Warner and B. S. Williams, eleven quarto volumes, containing 528 plates; "Illustrations of Orchidaceous Plants," London, 1857, by T. Moore, contains 100 plates selected from the "Botanical Register" and Sweet's "British Flower Garden;" "Dictionnaire Iconographique des Orchidées," Brussels, 1897-1907, by A. Cogniaux and A. Goossens, eight volumes of colored plates of flowers; and "Orchids, the Royal Family of Plants," Boston, 1885, by Harriet S. Miner, contains twenty-four plates with a popular account. Two periodicals, "L. Orchidophile," Paris, 1881-1892, and "Lindenia," Ghent, 1885-1906, were almost wholly devoted to the illustration of orchids, while "The Orchid Review," London, 1893, and continuing, is a more popular journal devoted to the interests of

orchid-culture in general. Many plates and descriptions of orchids have appeared in other serials like Curtis' "Botanical Magazine" and Lindley's "Botanical Register." Many of Reichenbach's species were described in the "Gardeners' Chronicle." A great many large manuals and handbooks have been published. Among them may be mentioned "A Manual of Orchidaceous Plants Cultivated under Glass in Great Britain," by James Veitch & Sons (A. H. Kent), London, 1887-1891, a very comprehensive manual of two volumes, containing many engravings; "Orchids: Their Culture and Management," by W. Watson, London, 1890, new edition, New York, 1903, with twenty colored plates and numerous engravings; "Les Orchidées Exotiques et Leur Culture en Europe," by L. Linden, A. Cogniaux and G. Grignani, Brussels, 1894; "The Orchid-Grower's Manual," by B. S. Williams, seventh edition, London, 1894, a large manual with numerous illustrations; and "Die Orchideen," by R. Schlechter, Berlin, 1914, 1915, a comprehensive handbook and manual giving the most recent taxonomic treatment of the cultivated orchids. Besides these larger works suited to the technical needs of the cultivator, a large number of popular works have appeared. Among these are: "Orchids for Everyone," by C. H. Curtis, London and New York, 1910, a beautifully illustrated popular handbook; "Woodlands Orchids," by F. Boyle, London, 1901, a popular account of orchids with stories of their collecting; "The Book of Orchids," by W. White, London and New York, 1902; "Culture of Greenhouse Orchids," by F. Boyle, London, 1902; and "Orchids," by J. O'Brien, New York, 1911; "Our Native Orchids," by W. H. Gibson, New York, 1905, a popular account, with illustrations; and "Lilies and Orchids," by Rosina C. Boardman, New York, 1906, contains color-sketches of seventeen native species. Among the works of a more technical and monographic character containing plates of orchids should be mentioned "The Orchids of the Sikkim-Himalaya," by Sir George King, Calcutta, 1898, 448 engraved plates (in "Annals of the Royal Botanic Garden," Calcutta, Volume VII); "Icones orchidearum austro-africanarum extra-tropicarum," by H. Bolus, London 1893-1911, 250 partly colored plates with descriptions; "Orchidaceae," by O. Ames, Boston and New York, 1905, five fascicles giving illustrations and descriptions of new or recently described species which had been inadequately figured up to the time of the appearance of the work; and "Die Orchideen von Java," by J. J. Smith, Leiden, 1905-1914, one volume, text and one volume plates. Finally may be mentioned the work of F. A. Bauer, "Illustrations of Orchidaceous plants," London, 1830-1838, an account with thirty-five colored plates showing the structure and morphology of the various genera.

The illustrations accompanying the present article are in part borrowed or adapted from German sources, as follows: Figs. 2631, 2638, 2650, 2651, 2652, from Pfitzer in Engler & Prantl's "Die natürlichen Pflanzenfamilien," II. 6; Figs. 2625, 2626, 2627, 2630, 2632, 2633, 2634, 2641, 2643, 2644, 2645, 2646, from Pfitzer in Grundz. einer Vergl. Morph. d. Orch., and Morph. Studien ü. d. Orchideenbl.; Fig. 2653 from J. G. Beer, Betr. Morph. u. Biolog. d. Orch.; Figs. 2654, 2655, from Burgreiff, Anz. Tropisch. Orch. Samen.

HEINRICH HASSELBRING.

The general culture of orchids.

In the early days of orchid-culture, the treatment of the plants under glass was imperfectly understood, and with the meager knowledge of the natural conditions surrounding them in their native habitats, little successful progress was made for many years. The few cultural directions to be found were in works of foreign publication, scarcely applicable to plants grown in houses in America, where the winters are severe and

changeable and the heat of summers more intense and less humid, necessitating a different mode of treatment. With a more satisfactory understanding of their requirements, orchid-culture here has made rapid advance in recent years, and most of the best collections have come into existence, many of which offer a very favorable comparison in fine well-grown specimens with those of the Old World.

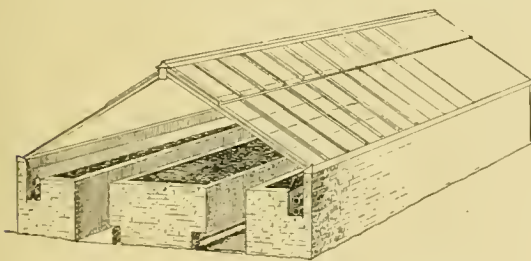
Orchid houses and their construction.

Various are the opinions of cultivators regarding the proper construction of orchid houses to secure the best results. Forty or more years ago many fine specimens of orchids were grown without a special house, along with general stove and greenhouse plants, and many good plants are still found cultivated in this way, but where a general collection of orchids is grown, four separate houses or divisions will be found necessary to obtain the best results. These are known as the "East Indian," "Brazilian," "Mexican" and "New Granadan," or *odontoglossum* departments. This is the older terminology, but it represents a good cultural classification.

The East Indian department requires a winter temperature of 65° to 70° F. by night and 70° to 75° F. by day; a few degrees' rise with sun heat will do no harm. The temperature should be gradually increased 10° toward midsummer and gradually decreased toward late fall. This is the warmest house and is used for the cultivation of *aërides*, *angræcums*, the warmer tropical *cypripediums*, *phalenopsis*, *calanthes*, *dendrobiums* and *thunias* while growing.

The Brazilian department should range in winter from 60° to 65° F. at night and about 70° F. in the day, allowing a few degrees more with solar heat, and a rise of 10° toward midsummer. This department is for *bulbophyllums*, *cattleyas*, warm *epidendrums*, Brazilian *lælias*, *miltonias* of the *cuneata* and *spectabilis* sections, *Odontoglossum citrosimum*, *stanhopeas*, and various genera and species requiring a like temperature.

The Mexican department is used chiefly for the cultivation of *Calogyne cristata*, Mexican *lælias*, growing *lycastes*, *angulos* and *acinetas*, many species of *Maxillaria*, a large part of the *oncidiums* and warm *odontoglossums*, *phaius* and allied species which require a few degrees lower night temperature and usually a little more sunlight to ripen their tissue for flowering



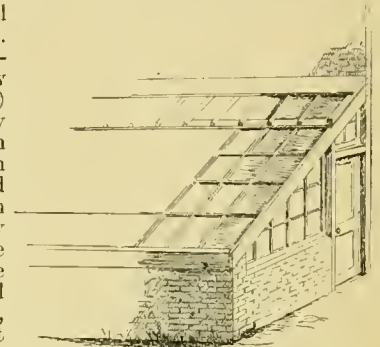
2656. Section of a small, well-constructed orchid house heated by hot water.

than is afforded in the Brazilian department. It is also invaluable for resting *dendrobiums* and many other deciduous and terrestrial orchids.

The New Granadan (it might now be called the Colombian) or *odontoglossum* department must be kept as cool as possible in summer, and in winter should range from 50° to 55° by night and to 60° F. by day; it is used principally for *masdevallias*, *odontoglossums*, more especially *O. crispum*, and allied genera, *disas*, cool *oncidiums*, such as *O. ornithorhynchum* and *O. varicosum*, *lycastes* in warm weather, and many other individual species from high altitudes which require a cool

house at all seasons for they suffer from the heat of our summer.

Styles of construction change, but the fundamental principle in building an orchid house is to secure a structure that can be easily heated and which has a naturally moist atmosphere without excavating deeply, for houses built much below ground lack circulation and almost always prove detrimental to orchid-culture. The houses (excepting the New Granadan house) should preferably be built to run north and south with an east and west exposure, in order that they may receive the benefit of the early morning and late afternoon sun, with the least possible heating effects from it at noonday, thus making little ventilation necessary; atmospheric moisture will be more easily retained in such a structure. The houses may be as long as required (with the potting-shed at the north end to avoid unnecessary shade and protect the houses in winter against severe north wind), and about 16 feet wide, which will allow side beds of 2½ feet each, two walks of the same width, and a center pit 6 feet wide. From floor to ridge should be 10 feet and to the eaves 4½ to 5 feet. Top ventilators should extend along both sides at ridge, thus affording protection from direct cold winter drafts in airing by using the sheltered side. Side ventilation is unnecessary and often injurious, the direct drafts causing plants which are out of condition to shrivel.



2657. Lean-to house with northern aspect for *Odontoglossum crispum* and other New Granadan orchids.

In glazing orchid houses, the glass should not be less than 12 by 14 inches, and larger if possible. It is also important that only the best quality procurable be used, free from lenses which burn the leaves when shading is removed. Plate glass is much to be preferred when it can be had, as it contains no lenses and gives a pure even light. If this is used a size about 16 by 24 inches will be found very serviceable. Poor glass should not be employed in any case, as it necessitates shading long before this is beneficial to the plants.

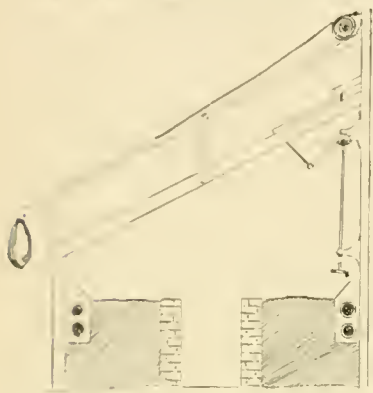
The outside walls should be built of brick or stone when possible, and the beds and pits within should be of the same material, 8 inches thick and about 3 feet in height, filled solid to the top, using stone or rubble for drainage in the bottom, following it up with finer material and finishing with an inch or two of fine gravel. Wooden benches may be used if desired, often with first-class results, by covering them 2 or 3 inches deep with ashes, sand or gravel, but the solid benches are more sure to give better satisfaction. They give off moisture more gradually and offer a cool footing for the plant both winter and summer, which is essential and natural.

Good results will follow from either steam or hot-water heating when properly conducted. Unless the range of glass is large and a night fireman is kept, the old-fashioned method of hot water under natural circulation will be useful for orchid collections, using the regulation 3½-inch pipe, running the flows along the back beneath the eaves and returning along the floors beneath. (See Fig. 2656, which fairly illustrates an acceptably constructed house.) The quantity of pipe required for heating a house depends upon the location and degree of heat desired. A slab or board should

be placed along the back of the side beds to throw the heat against the eaves and protect the plants from direct heat before it has assimilated the moisture of the house.

The New Granadan house should be a lean-to structure of northern aspect, with a wall of stone or brick along the south side to protect it from solar influence as

much as possible (see Fig. 2657). The glass should be protected by canvas roller shades raised 15 or 20 inches above the glass on framework. One side of the canvas should be tacked along the top of the house, and the other to a round wooden roller 3 or 4 inches in diameter and as long as convenient to draw up; the two ropes should be fastened to



2658. Cross-section of New Granadan orchid house to show solid beds and methods of heating and shading.

the ridge, carried down beneath the shade around the roller, and up over the top to a single pulley near the ends; thence through a double pulley in the center and down over the top of the shade to the ground. By these ropes the shade can be raised and lowered in cloudy and bright weather at will. (See Fig. 2658.) Solid beds and piping similar to the other orchid houses can be used, or as in Fig. 2658; viz., a flow and return down each side connected with valves so that either or both sides may be used as desired.

Shading of some sort on the glass is necessary for all orchid houses from early February until November, and in some cases also in the winter months, to protect the plants from the sun. It may be of canvas, as in Fig. 2659, or consist of whitewash or paint applied directly to the glass. Whitewash made from fresh lime is perhaps the best to use, as it is easily removed in autumn. The first application in February should be light, following it with a second coat a month later, and, if necessary, a third in July. This will wear off gradually and in most cases should be entirely removed in December. It is easily removed with a stiff brush. There are also patented shadings.

The two great horticultural groups.

Orchids are horticulturally divided into two large sections: terrestrial and epiphytal, the former embracing those that grow on the ground and derive their nutriment more or less directly from it; and the latter those that usually attach themselves to rocks and trees, and derive a greater portion of their nutriment from the atmospheric gases and accidental deposit of decaying leaves, or grow among the various ferns and vines, which grow in abundance on the rocks and trees of the moist, wooded tropics, absorbing the various elements of their slowly decomposing humus.

Terrestrial orchids grow at various altitudes, and are widely distributed throughout both hemispheres, the polar regions and arid deserts excepted. Many are deciduous and tuberous-rooted; some grow from underground rhizomes; others are pseudobulbous and deciduous, while not a few have reed-like stems. Examples of terrestrial orchids are catasetum, calanthe, cyrtopodium, most cymbidiums, some of the cypripediums, *disa*, *goodyera*, *gonavia*, *habenaria*, *lissochilus*, many *masdevallias*, *microstylis*, *neottia*, *orchis*, *pogonia*, *peristeria*, *phaius*, *sobralia*, *spathoglottis*, all of which

should be sought under their special genus headings in other portions of this work for cultural directions. They differ very essentially in structure, and in many cases require a special method of treatment for individual plants of the same genus, as *Habenaria* for example, where some are found growing in rich, turfy loam exposed to sun, while others inhabit wooded, swampy locations.

Many species of terrestrial orchids nearly or quite defy successful treatment under cultivation from lack of knowledge regarding the mineralogy of their native habitats, or from the plants being practically saprophytic on certain species of decaying vegetation, or growing only in connection with the mycelium of special fungi, which may assist them in making proper growth.

The hardy species, when a general collection is grown, should be cultivated in pots in coldframes, as many need protection during winter and others require shade which can be supplied by painting the glass. Our native hardy species, however, do best planted out in a properly constructed rockery, laid out in pockets so that each may receive its proper compost.

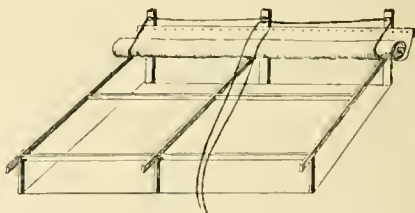
The more tropical species—cymbidiums, cypripediums such as *C. insignis*, *Phaius grandifolius*, *P. maculatus* and *P. Wallichii*, *sobralias* and some other evergreen species—thrive best in the Mexican or cool end of the Brazilian house.

Anacetoehilus, tropical *goodyeras* and cypripediums, *spathoglottis*, and several genera of like nature, require the same general treatment as epiphytal orchids, with temperature of the East Indian department at all seasons.

Bletias, *catasetums*, *cyrtopodiums*, *calanthes*, many *lycastes*, tropical *liparis* and *microstylis*, *Phaius Humboldtii* and *P. tuberosus*, *thunias* and many other deciduous and semi-deciduous species, should be grown in the East Indian, or warm end of the Brazilian department, and during the resting period should be placed in the Mexican department, allowing them only sufficient water to keep the plants in sound condition.

Epiphytal orchids are found chiefly in the humid forests of tropical countries, often along streams where they receive their moisture in the dry season. A few grow in open grassy situations or among brush. These consist chiefly of climbing epidendrum of the *E. erectum* section, a few oncidiums of the caulescent type (the distance between the pseudobulbs often denoting a year's growth), and some of the terete vandas, and others.

Aerides, *phalanopsis*, *vanda* and the epiphytal cypripediums are distributed throughout India, Malay



2659. Method of shading orchid houses.

Peninsula, Cochin-China, Celebes, Borneo, Philippine Islands, Java and some of the Oceanic islands, usually following the moist forests of mountain ranges, occasionally at high elevations. With one or two exceptions, as *Vanda cerulea*, all do satisfactorily in the East Indian department, reserving the warmest part for *phalanopsis*, which, as a rule, grows nearest the sea-level.

Angraecums are natives of Madagascar and tropical Africa, with one isolated species, *A. falcatum*, which is from Japan. They grow in humid, shady locations, where they can receive a copious supply of water at

all seasons, and are closely allied to vanda, requiring the same general temperature and treatment.

Dendrobiums are most common throughout India, Moulmein being a central district, but they are also plentiful and widely distributed throughout eastern Australia, New Guinea, the islands of the west Pacific and Oceania under various climatic conditions. The larger part of them, especially the deciduous species, are subjected to long droughts and long resting periods, but as they lose their foliage at that time their evaporating surface is reduced to a minimum, and the effect of the dry heat through the day is more than counteracted by heavy dews and the condensing vapors which arise in the early mornings in those countries.

Bulbophyllums and cecylogynes have their homes principally in the mountainous forests of East India and Borneo, where they are copiously supplied by frequent rains. Nearly all grow best in the Brazilian department.

Cattleyas and laelias inhabit the humid forests of the various mountain ranges of tropical America, from Mexico south through Colombia to Peru, the North Amazon Valley, through Venezuela and Guiana, and the mountain belt of eastern and southern Brazil, usually at an altitude of 2,000 to 5,000 feet, excepting the Mexican species, *L. albida*, *L. anceps*, *L. autumnalis* and *L. majalis*, which grow at 5,000 to 8,000 feet, commonly among polypodium fern.

Cattleyas and laelias grow on rocks and trees often devoid of other vegetation along the margins of rivers and ravines, usually in shade, where they receive a copious supply of water from heavy dews and condensation of morning fogs which saturate the forests during the dry season, and often excessive rains while growing. They should be grown in the Brazilian department, excepting *Cattleya citrina*, the Mexican laelias and *L. Jongheana*, which thrive best in the Mexican department or warm end of the New Granadan house.

Stanhopeas are found from southern Mexico south to Peru, Venezuela, Guiana and Brazil at rather low elevations, often in dense forests, the individual species having a very wide range. The Brazilian house affords them the best temperature, but they may be grown in any of the departments with success.

Epidendrum is a large and varied genus, widely distributed throughout tropical America and in the United States from South Carolina southward, and one of the few epiphytal genera inhabiting the United States. They are found at all elevations from sea-level to 10,000 feet or more. The writer found *E. ibaguense* growing in quantity on the margin of perpendicular clay ridges fully exposed to the sun at this altitude in the United States of Colombia in a robust, healthy state, and the same species below 5,000 feet in the same condition. Many of the individual species cover a wide range of distribution. They require the same general treatment as laelias and cattleyas. Few species are worthy of cultivation except for botanical purposes.

Maxillarias cover much the same range as the last genus, but are not quite so widely distributed. They grow equally well in either the Brazilian or Mexican departments.

Oncidium is distributed along the mountain ranges from southern Mexico to Peru, in the southern and norther portions of Brazil, chiefly along the coast, the Spanish Main and islands of the Caribbean sea. The *O. carthaginense* and *O. Papilio* sections are found at sea-level and seldom above 500 feet elevation. These grow best in the Brazilian house. Nearly all of the other species may be grown in the Mexican department, except a few, such as *O. cucullatum*, *O. Phalaenopsis* and the *O. macranthum* section, which are found at high altitudes; these should be grown in the New Granadan department.

Odontoglossums follow the higher wooded mountain ranges from southern Mexico, Central America and the Central Andes of Colombia south to Peru and the northwestern portion of Venezuela, all at high altitudes.

They usually grow in the moist shady forests, where the rainy season is long continued or condensing fogs and dews are very heavy, keeping many of the species in an almost perpetual state of saturation, their only relief of excessive moisture appearing to be from the frequent heavy winds that prevail in these regions. The Mexican species grow well in the cool end of the Mexican department, while those of the *O. luteo-purpureum* and *O. crispum* type require the New Granadan house.

Lycastes are distributed from southern Mexico to Peru along the mountain ranges, usually at an altitude of 4,000 feet in rather shaded locations; they are most common from southern Colombia to their northern limit. *L. tetragona* is from southern Brazil and far removed from the general area of distribution, with little resemblance to any other species. Its 4-angled monophyllus pseudobulbus produce semi-pendent scapes carrying often as many as eight flowers, not unlike a cymbidium in general appearance. Lycastes grow well in either the Mexican or New Granadan department.

Selenipediums are the South American representatives of cypripedium. They are distributed from Costa Rica south to Bolivia, through Venezuela, Guiana and eastern Brazil, from 3,000 to 8,000 feet elevation, in wet marshes and on the branches of trees in shaded forests, in all cases where they get a bounteous supply of water at all seasons. The Brazilian or Mexican department suits them equally well.

Masdevallias, restrepias, and pleurothallis grow at high elevations in Venezuela, Mexico and south to Peru, with a few in the Organ Mountains of Brazil, their principal center being Colombia near the odontoglossum district. They always follow the mountain ranges, growing on trees, rocks and on wet, marshy slopes, in extremely wet locations. The chimera section is found at the lowest elevation. They all grow best in the New Granadan department.

Newly imported orchids.

On arrival of cases of orchids from their natural habitats, they should be carefully unpacked as speedily as possible, in an isolated room where insect pests that often arrive in the cases may be destroyed, and laid carefully and loosely against one another, on the bench of a shady well-ventilated house or packing-shed. Should they all be found in good condition, the pseudobulbous species, such as cattleyas and laelias, should be hosed over thoroughly and allowed to remain for about a week, at the end of which time they should be examined for any signs of decay and bruises. All such parts should be removed with a sharp knife. The plants should be cleaned and sponged to remove dust, potted or basketed, as the case requires, and placed in a shady portion of their respective departments, allowing them sufficient water gradually to start them into action, after which time they will require the same treatment afforded established plants of their kind.

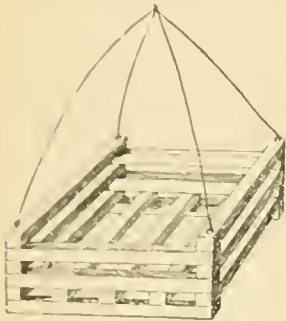
Cypripediums, masdevallias, phalaenopsis, vandas, the batemannia and bollea sections of zygopetahum and other non-pseudobulbous genera should be placed on damp sphagnum in a well-shaded airy department for a week or ten days, without syringing, until it is ascertained what amount of damage they have received in transit. After sponging the leaves carefully and removing any decayed and bruised parts, they may be potted and basketed, and removed to their proper quarters, watering sparingly until they start new action.

It is customary in some establishments to hang newly imported orchids by the roots, tops down, from the roof of the house or beneath the benches until they show signs of new action, but they invariably suffer more or less from this practice and are better treated as above.

Pots, baskets, and supports.

Many orchids are best cultivated in the ordinary earthen pots and pans, more especially terrestrial

species and a few of the epiphytal kinds, which grow on rocks in marshes, and among quantities of humus and fern roots. Most of the epiphytal species, however, need special structures that will admit air to circulate freely to the roots; otherwise, these are liable to decay through excess of water if confined in close pots when inactive in winter, which must eventually weaken the constitution of the plants.



2660. Commonest and best style of basket for general culture of orchids with pendulous scapes.

The best and most practicable pots and baskets are shown in Figs. 2660 to 2661. Fig. 2660 shows the orchid basket most commonly used; it is the best adapted for the general culture of cattleyas, coryanthes, dendrobiums, epidendrums, kelias, masdevallias of the chimera section, oncidiums, and most orchids with pendulous flower-scapes. They may be made of cedar, teak-wood, cypress, or any durable wood. The wood is cut into square (or round) sticks of any length desirable and in proportionate thickness from $\frac{1}{2}$ to 1 inch, and carefully perforated at each end. Through the holes is inserted a strong wire, which is looped at the upper end when finished in order to receive the wire hanger. These baskets may be as deep as desired, but three sticks on each of the four sides are usually enough for most orchids, with two or three placed crosswise through the bottom, to hold the compost. The hanger is made by twisting together and bending down in the middle two pieces of galvanized or copper wire, thereby forming four ends to insert in the basket-loops and a loop or hook at the top by which to suspend it.

The orchid cylinder (Fig. 2661) is very useful for standing on the bench or pit, and is used for renantheras, aërides, vandas, angræcums, epidendrums, and many other tall plants that are too tall or difficult to suspend. Cylinders are made in all sizes and any diameter desired, with either square or round sticks. They are bored a short distance from the ends and a wire inserted through them, with a small block between each stick, to make an opening for air. When large enough the sides are brought together and fastened. The depth is adjusted by movable cross-pieces.



2661. An orchid cylinder, used for very tall species.

The earthen basket (Fig. 2663) is useful when the compost is fine and when the roots do not require much atmospheric action; also properly to mature tissue in a few terrestrial species, thereby inducing them to flower more freely. The earthen basket is especially useful for acinetas, peristerias with pendulous scapes, stanhopeas and others; it is made with ovate openings around the sides and a round one in the center to admit pendulous scapes.

The perforated pan (Fig. 2664) is usually made only in small sizes and used for bulbophyllums, the concolor type of cyripedium, dendrobiums, and many other

small-growing species that do well suspended from the roof.

The perforated orchid pot (Fig. 2665) is for bench use and is useful for many epiphytal orchids that are not to be suspended, the perforations or holes supplying abundant air to the roots, a safeguard against losing them through overwatering in winter.

Figs. 2666 and 2667 show the standard earthen pot and pan for terrestrial species. They should have the drainage holes made on the side at the base, instead of directly underneath, as a preventive against earthworms entering from the benches.

Potting of terrestrial orchids.

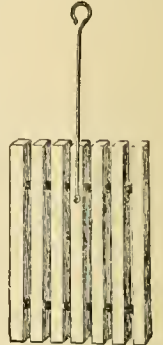
Terrestrial orchids as a rule grow best under pot culture. Potting material for the following genera—acanthophippium, bletia, calanthe, cymbidium, *Cypripedium insigne* and most of the hardy species, cyrtopodium, habenaria, liparis, microstylis, peristeria, phaius, pleione, sobralia, thunia, and some others—should consist of about one-third each of chopped sod with some of the fine soil removed, chopped live sphagnum and leaf-mold, adding a little ground bone for some of the strong-growing kinds. One-third of the pot space should be devoted to clean drainage, covered with sphagnum or rough material to keep it open. After removing all decayed parts, the roots should be carefully distributed and the compost worked in gently but firmly around them, leaving the surface a little convex and slightly below the rim of the pot as in Fig. 2666 (the dotted lines denote drainage required). The convex surface gives the rhizome an opportunity to dry out frequently, thus avoiding fungi, which are troublesome to some species.

In repotting terrestrial orchids, sufficient pot room should be given to last a year or two if possible, as they dislike to have their roots disturbed oftener than is necessary. The best time to repot is just before the rooting period, or when they are starting their new growths in spring. The deciduous species of calanthe can be easily increased at this time, if desired, by removing the old bulbs and placing a number together in a pan or shallow box, covering them partly with compost and placing them in a warm house until they start action, after which time they should be potted as desired, two or three together.

Anætochilus, arphyllums, cyripediums, disas, goodyeras, spathoglottis, and many allied genera, grow best under pot culture, but otherwise require compost and treatment similar to the epiphytal kinds.

Potting, basketing, and compost for epiphytal orchids.

The roots of epiphytal orchids are usually very porous, and many are covered with a corky substance (velamen), capable of absorbing and retaining water for considerable time. In their native homes a great many of the roots are aerial or grow in loose, fibrous material, such as moss and the fine roots of polypodiums and other ferns, where they have free access of air at all times. It is important that they receive similar treatment under cultivation so far as is consistent with the difference of their environment taken into consideration. Thus it is apparent that one of the special features in the culture of epiphytal orchids lies in the proper selection of com-



2662. An orchid raft, used for much the same purpose as the cylinder.



2663. Earthen basket, for stanhopeas and other orchids, whose pendulous scapes issue through the holes in the bottom.

post and the method of potting and basketing for the best results in after-cultivation.

Peat fiber, sphagnum moss and leaf-mold constitute the principal materials of good compost, usually lasting one or two years without renewal, which is important,



2664. Perforated pan, adapted to small orchids that do well when suspended from the roof.

as the roots suffer more or less in being disturbed. By peat fiber is meant the fibrous roots of various wild ferns, with the fine soil removed by first chopping it into small pieces, then rubbing it across a coarse sieve. The several species of osmunda furnish us with the best orchid peat. (See *Osmundine*, page 2414.) The sphagnum moss used for orchids should consist of *Sphagnum squarrosum*, *S. macrophyllum* and the coarse-leaved species only; *S. acutifolium* and other weak-growing species should never be used, as they soon decay and are detrimental to the roots.

Leaf-mold is made from decomposed leaves. The leaves of almost any tree will do, but those of hardwood trees are most desirable, especially oak. When collected in the fall the leaves should be heaped up to decay for a year or more, and turned over at least twice within that time.

Charcoal is the best material to use for drainage and for mixing or interspersing with the compost. It is best made from hardwood and should not be overburned. Broken potsherds are often used, but they are not so good; being porous, they either absorb too much water at times or become over-dry too often and are liable to prove injurious. Charcoal is lighter in weight, and contains more useful properties.

Where closed pots are used, nearly one-half of the space should be devoted to drainage and the remainder to compost, consisting of about equal parts of peat fiber, chopped sphagnum and leaf-mold for most genera, adding a few pieces of charcoal in potting, and a piece beneath the rhizome of the tender ones. Care must be exercised in potting to distribute the roots properly and make the compost moderately firm about them, leaving the finished surface convex, to throw off surplus water and protect the rhizome from an overabundance of wet. Top-dressing with live sphagnum is beneficial to many orchids, such as *Odontoglossum crispum* and allies, and gives the surface a neat appearance. Fig. 2668 illustrates a finished pot, the dotted line in Fig. 2666 indicating the amount of drainage required.

When perforated or open-work pots or baskets are employed, no direct drainage is necessary. Rough, broken pieces of charcoal should be freely used in the compost while potting, as it helps to keep the mass firm and the roots of nearly all species attach to it freely; also it lessens the quantity of compost and so modifies its texture as to allow it to dry out more readily than when packed in a solid body.



2665. Perforated orchid pot, adapted to epiphytes which need plenty of air at the roots and are in danger of over-watering.

Cattleyas of the *C. intermedia* type, coryanthes, cyripediums of the *C. Lorei* and *C. Stonei* sections, some dendrobiums, *Oncidium carthagenense*, *O. crispum*, *O. macranthum*, *O. Papilio* and their allies should have the leaf-mold omitted, while aërides, phalaenopsis, saccolabiums, vandas and kindred genera require only chopped live sphagnum and charcoal as a compost.

Watering, humidity.

It is impossible to lay down any hard and fast rules for watering orchids. Watering is a very important operation and requires more or less practical experience, connected with a knowledge of the general conditions surrounding the plants in their native homes. As a rule, most orchids

need a liberal supply while growing, but the condition of the plant and compost and the manner in which it is potted or basketed have much to do with this.

The evergreen terrestrial species, which grow chiefly in loam fiber, as cymbidium, *Cypripedium insigne*, phaius, sobralias, and others, require water whenever the surface of the compost is becoming dry, with occasional light overhead syringing in fine weather, which will assist in keeping down red-spider, thrips and other pests. An occasional application of weak liquid cow- or sheep-manure is of great benefit while the plants are growing.



2666. Standard earthen pot for terrestrial orchids, with drainage holes at the side instead of at the bottom.

The deciduous species have a decided period of rest, at which time they are practically inactive and need very little water, enough only to keep the stems and pseudobulbs in sound condition. When growing, however, they require a good supply and should have a thorough watering to the bottom whenever the soil is becoming dry, but should not be kept in a wet condition at all times, or the soil soon becomes sour and infested with worms, under which condition no orchid can do well.

Epiphytal orchids, or a greater part of them, in their native habitats grow in locations where heavy rains are frequent or of almost daily occurrence in their growing season, and where condensing vapors settle on them like dripping rain, while the early morning fogs rise among the forests, charging the atmosphere almost to



2667. Standard earthen pan for terrestrial orchids, showing side drainage holes.

saturation in the early part of the day in the resting season. Such species as are subjected to a severe dry resting season are often deciduous (see *Dendrobium*, and also, page 2393). Many of the extremely alpine species, such as the masdevallias and *Odontoglossum crispum*, are subjected to two annual rainy seasons, and where these seasons are much prolonged it

has been observed that the last-mentioned species in its native habitat mature as many as three pseudobulbs in the year. Thus the pseudobulb is no indication of annual growth, but a reservoir of supply in case the plant is overtaken by severe or sudden droughts, each pseudobulb being supplied with a mature secondary bud for further reproduction should the proper lead be destroyed.

Such genera as aërides, cyripediums, masdevallia, vanda, and the like, which have no pseudobulbs, rely more or less directly on a daily supply at all seasons. These, with many of the extreme alpine species, should have a liberal supply of water at all times.

Many of the pseudobulbous kinds, including cattleyas and laelias, are also constantly in action perfecting new roots or maturing their flower-buds, after the pseudobulbs are completed and they are apparently at rest. For this reason careful observation of each species is necessary to make their cultivation successful.

Under basket culture, there is least liability of injury through overwatering, and excepting kinds like the oncidiums and dendrobiums (which need a dry and cool resting period to induce them to flower), and deciduous species at rest, nearly all should receive a good supply of water, weather permitting, whenever the compost is becoming dry, with frequent syringing overhead in fine weather, when the temperature is normal and ventilation can be given. A stimulant of weak sheep- or cow-manure applied occasionally to plants in action will benefit them.



2668. Method of potting an epiphytal orchid, showing the raised and round top of sphagnum.

On cold, cheerless days, when the temperature is below

normal and the atmosphere is overcharged with moisture, very little watering or damping is needed, and unless it be some particular species which cannot endure drying, or tiny seedlings, it is safest to withhold water, as at these times the stomata cease action and the plants become overcharged with water; thus those with weak constitutions and immature growths are liable to attacks of wet-spot and rot. The best means of counteraction in such cases is to apply fire heat and ventilation. A close stagnant atmosphere is always to be avoided.

As a safeguard against excessive changes in humidity, a hygrometer should be kept in each department to ascertain and regulate the degrees of moisture, especially during fall and winter. When overabundant, moisture can be reduced by applying fire heat and ventilation, and if insufficient by wetting down the paths and shelves, or pits, and reducing the ventilation. Well regulated departments should be kept as near as possible to 70° or 75° through the day or 80° to 85° with free ventilation, and about 80° at night. Just after damping and watering, it will often rise to 85°, but this is of no consequence, as it soon recedes. Orchids at rest, such as calanthes and dendrobiums, should be held at 65° to 75°. In no case, where it can be avoided, should it go below 60° nor rise above 90° for any length of time, as serious results are very liable to follow.

Ventilation.

The ventilators should extend the entire length on both sides of the ridge, and be supplied with the best modern lifting apparatus. Extending them continuously along the roof necessitates raising them but a small height to afford proper circulation to the plants and egress of overheated air, without losing too much moisture. Having them on both sides assists in avoiding direct drafts, by using the side protected from the direct wind.

Air must be given at all times, when possible, to keep the atmosphere active, as well as to lower temperature, also to reduce the density of moisture when excessive in close, inclement weather and during the night. In bright weather ventilate enough to allow egress of the heated air.

It is customary with some cultivators to close down ventilators in wet weather and during the night to help retain heat. This is a serious mistake. It may show no visible injury in bright weather, when the density of moisture in the atmosphere is at a minimum, but this bad practice surely accounts for the decaying of many young growths, which are lost during wet, close and cloudy nights.

Propagation.

Many species of orchids can be propagated by division and by cuttings. This is usually resorted to when it is desired to increase the stock of rare and unique species and varieties. With the more common species, however, it is cheaper and better to buy freshly imported stock, if it can be had, as it often requires two, three or more years to bring the young plants up to the flowering stage.



2671. Eight months from seed.
Phaius Waltichii.

The pseudobulbous species, such as cattleyas, odontoglossums, cecylogynes, are propagated by cutting part way through the rhizome three or more pseudobulbs behind the lead with a sharp knife. This will usually retard the sap and force the dormant eye behind the cut to grow. The back portion may then be removed and potted or basketed separately, or left on the plant to mature the new growth, and be removed when it starts action the following season.

With the deciduous calanthes, the old bulbs should be removed when potting them in spring and put, several together, in pans or flats and partly covered with sphagnum or potting compost until they start to grow, when they should be potted in the regular way. Thunias are easily propagated after the young growths are well advanced, by cutting the last year's stems into pieces 4 or 5 inches long and inserting the ends in chopped sphagnum and sand, placing them in the propagating-house until they grow, when they may have their normal heat. Dendrobiums are managed in much the same way, or the old canes can be laid on wet sphagnum, when many will produce new growths from the side eyes on the nodes. Aërides and yandas are increased by removing the upper portion with a sharp knife, leaving a few roots and at least a foot of stem to each top. The old bases of the stems usually break new growths freely, often producing several new shoots from each. Cyripediums should be divided between the older growths, leaving at least one old growth with each lead, and potted separately, allowing them a little extra moisture until they start to grow. Masdevallias and allied genera can be separated in the same manner, leaving several leaves and one or more new growths or leads to each piece. All species should be propagated at the commencement of the growing season.

Reproduction of orchids from seed.

The reproduction of orchids from seed through crossing and hybridizing has been conducted for many years successfully by a limited number of hybridists, principally abroad, and it is only within about twenty-five years that it has received much attention in America, but in that time very many beautiful hybrids have come into cultivation. Many of our establishments, both private and commercial, are now paying much attention to this branch of orchid culture, with varying degrees of success.

The seeds germinate best when sown soon after maturity, and many lose their vitality in a few months if kept too dry and warm. When sowing the seeds, the best results are often obtained when they are dusted on the surface of pots or baskets containing a plant of the same genus as the seed and carefully watered with a very fine rose until they become attached, watching carefully for snails, slugs, and depredators in general that infest the compost. The pots or baskets should have a favorable-looking surface, with the compost in good condition, firm and free from fungi. Use pots or baskets that will not have to be disturbed for a year or more, as it often takes that length of time for the seedlings to come through. Seed sown in early spring seems to germinate soonest. The writer has had selenipedium seedlings up in three months from sowing, and again has waited for cyripedium twenty-three months before the seedlings appeared.

After the seedlings have perfected two or three leaves it is quite safe to remove them to small pots, singly, or several to a small pan, using compost of the same material as that for the parent, but cut a trifle finer. Many tiny seedlings are lost shortly after germi-



2672. A year from the seed.
(*Cattleya intermedia* × *C. labiata*.)

nating, through the soil becoming sour or through fungi. When thus attacked they should be transferred to other pots or baskets not infested.

A newly germinated seedling of *Phaius hybridus* is shown in Fig. 2669. Fig. 2670 is of a three-months-old seedling of *Cypripedium*



2673. Thirteen months from seed. (*Cypripedium*.)

insigne var. *Sanderæ*, in proper condition to be transferred to a pot; Fig. 2671, eight-months-old plant of *Phaius Wallichii*; Fig. 2672 a twelve-months-old hybrid cattleya (*C. intermedia* × *C. labiata*); Fig. 2673 a cypripedium thirteen months old; Fig. 2674 a two-year-old hybrid between a cattleya and lœlia (*C. intermedia* × *L. præstans*).

The raising of orchids from seed should be encouraged, and should enlist the energy of every orchid-culturist, not necessarily for the production of hybrids, but also for the reproduction of rare species and varieties, and to save a number of species that are fast decreasing or becoming extinct in their native homes. Aside from the financial inducement offered the commercial grower, it will prove instructive to the botanist and afford pleasure and pastime for the amateur.

Diseases.

Orchids are subject to many diseases. Those having importance from a cultural standpoint and most troublesome to the grower are known as wet-rot, dry-rot and spot. Wet-rot is brought on by an overmoist or stagnant atmosphere, and is usually first detected by a semi-transparent appearance of the parts affected, which soon become dark brown. It spreads slowly along the tissue. If noticed at the commencement, it can be readily checked by slitting the epidermis with a sharp knife and removing the plant to a more airy position in the house for a few days.

Dry-rot is caused by a fungus which attacks the rhizome of the plant. It is often produced through burying the rhizome or base of the plant with compost. Cypripediums are subject to it. Large, healthy growths when attacked quickly show a sickly pale color in the foliage, which, on examination of the base, will be found discolored, and with a light brown appearance. If the portion attacked is quickly removed with a sharp knife it will usually give no further trouble; otherwise it will travel through the entire rhizome and destroy the plant in a very short time.

Spot comes from various causes: the appearance of small dark brown spots on the succulent leaves and pseudobulbs is usually an indication of cold and overwatering. Spot also arises through weak tissue, especially in phalaenopsis, saccolabiums and angraecums during winter, which have been grown too warm, shady and moist. The affected parts should be slit with a sharp knife and a little flowers of sulfur should be rubbed over the wound. When they make new growth the plants should be placed in a brighter and more airy position to induce a better growth. The brown dots which make their appearance on the leaves, especially at the apices and on new growths of deciduous and plicate-leaved species, indicate either lack of sufficient water at the roots or an over-dry atmosphere, both of which conditions can be easily changed.

Snails and insects.

Orchids are attacked by many forms of snails. Insect pests are a great annoyance to the cultivator. They can be kept in subjection only by constant attention. Slugs and shell snails are very destructive. If allowed to increase they devour young shoots, roots and flower-buds. The best means of capturing them is to place

saucers of dry bran on the shelves among the pots, and look them over morning and evening. By this means many will be destroyed. Various species of scale insects attach themselves to the leaves, pseudobulbs and rhizomes of nearly all species of orchids, and can be eradicated only by the use of a soft brush and washing with a sponge and water. A little whale-oil soap added to the water is of great assistance, and also useful in destroying red-spider, green-fly and yellow-fly. Black and red thrips attack the young growths of many species and often become very troublesome. Fumigating the houses with tobacco stems lightly about three times during the week will soon cause them to disappear. Fumigation is also a sure remedy for green-fly.

The cattleya fly is very injurious to young growths of cattleyas, lœlias and some epidendrums. The flies lay their eggs in the very young growth at the base, causing an enlargement which is easily distinguished. The only remedy is to remove the growth and burn it. The mature fly can be eradicated by fumigating the house with tobacco stems about three times each week during early spring.

The dendrobium beetle larva burrows in the stems of various species of the genus, and is detected by a small discolored spot. There is no remedy, except to cut away and destroy the parts attacked. A pest much more to be dreaded is the dendrobium mite, which perforates the canes and rhizomes of dendrobiums and many other orchids, laying a number of eggs in each perforation. On hatching, these eat away a part of the plant around them, causing that portion to decay. They can be found only by careful and close observation, and this often after the plant is beyond redemption. There is no remedy but cutting them out, and unless the plant attacked is valuable it is best to burn it and keep the pest from spreading.

Mealy-bug is usually not very troublesome to orchids. It is readily seen and destroyed without much injury to the plant.

Roaches are usually very troublesome, and hard to eradicate, as they feed at night and remain hidden through the daytime. They destroy roots, growing shoots and young flower-buds and scapes. Bran, powdered sugar and paris green, mixed together and placed around the houses in saucers, will usually keep them in subjection, and they should be hunted down at night by the aid of a lantern. Many can be caught in this manner.

Sow-bugs or wood-lice are usually common in every part of orchid houses, pots and baskets. They do a great deal of damage to young leaves, roots and the tender portions of flower-scapes. The paris green mixture used for roaches is very effectual in reducing their number, but it is impossible to be entirely freed from them.

ROBERT M. GREY.

Hardy orchids.

Many of our native species of orchids are very beautiful, and some are easy of culture, given suitable situations as to soil, moisture, and, in some instances, shade. It seems almost impossible to tame these wildlings, in the sense of making them border plants; the desirable situations are shady moist places in the woods for the habernarias, *Galeorchis (Orchis) spectabilis*, listera, and goodyera. Moisture, however, does not mean a stagnant condition of the soil, but slight depressions that are preferably above the level of surrounding soil, so that drainage is secure.

The two-leaved habernarias, such as *H. Hookeriana*, *H. orbiculata*, *H. blephariglottis*, and *H. dilatata* all occur



2674. Two-year-old hybrid between a cattleya and lœlia.

in shady woods. One seldom finds more than an isolated specimen or two, but these may be easily transplanted after their flowering period, taking care to keep the fleshy tuber-like main root intact. *H. psycodes* is a bog-plant and is often found in colonies, and this species is widely distributed. *H. ciliaris* grows in bogs in great numbers, and, when in bloom, the bright orange-colored flowers make a beautiful display in late summer. *H. fimbriata* is also a very showy bog-plant, enjoying the full sun. The arethusa often colors New England wet pastures a bright rose-purple in early summer where it is found in quantities very unusual in orchids; it requires very careful handling in digging when transplanting. Some of the soil should be dug with the plant to ensure its growing, and the same is true of the calopogon and pogonia, which also have pretty pink or purple flowers. Good success has been had in establishing colonies of goodyeras on shady banks; the three species, *G. repens*, *G. pubescens*, and *G. Menziesii*, which are very common in the North woods, have beautifully variegated leaves prostrate on the ground, and when in bloom are as pretty as the spiranthes, and a colony can readily be established.

The species of spiranthes are also easy to naturalize. It is found, however, that these plants appear to bloom biennially; one season the dry fields will be dotted with the pretty white flower-scapes, and the next year not one is visible. They have been dug in large numbers, but do not bloom the next year; it seems they require a year in which to recuperate. The common species are *Spiranthes gracilis* and *S. cernua*, both very easily naturalized, as the roots can be dug with a little soil attached. *Aplectrum hyemale*, found but rarely, is easy of culture and transplanting, owing to its having bulbs like many exotic species. The bare flower-scape arises in early summer, and afterward a single broad evergreen leaf appears to mark the place. *Liparis liliifolia* also has fleshy bulbs above the ground, is easy of cultivation and when the purplish lipped flowers are open, a little colony is very pretty and interesting.

The cypripediums are the best known and most sought of native orchids, *C. spectabile* is becoming rare and more difficult to get, but there are plenty of places in the remote North woods where it is still found in quantity. This plant is usually regarded as a bog habitant, but it occurs also on the slopes of shady ravines. *C. pubescens* is found in the same situations, and *C. parviflorum*, the smaller yellow species, is a bog-plant. All these are easy of cultivation if moisture is secure. They are found at times where it seems to be very dry at the roots, but an examination proves that there is seepage from above that provides the necessary moisture, and gives a clue to their culture. In the ravines on the shady slopes, cypripediums reproduce themselves from seeds to a greater extent than is supposed under cultivation, and the pretty yellow and pink flowers are much admired and sought. *C. parviflorum* is exceedingly fragrant when in bloom. *C. acule*, the common red-and-brown species, is not so tractable, but on sloping banks in partial shade they have flowered for two years and seem to be established. Two other species, *C. arcticum* and *C. candidum*, are hard to obtain, and more difficult to grow than the others, but with care and study of their natural conditions, it is probable that success may be attained with them. There are several Pacific coast cypripediums that have not proved tractable. Possibly they are hardy in the East under proper conditions; this is the case with *Epipactis Royleana*, and *C. californicum* and *C. montanum* are valued in gardens abroad. There are also some fine new species from China and Tibet that give promise and have flowered in Massachusetts gardens from roots brought home by Wilson. We may yet see these widely distributed. There seems to be no recorded example of hybridization among our native cypripedes; it has been attempted many times, and it

is strange, in the light of the numberless crosses made among the exotic species, that ours remain true even to themselves, and cannot be mixed.

There are many small gardens in which the study and culture of hardy orchids might well be taken up, together with that of the ferns. The same conditions might be made ideal for both in a very limited area. It is essentially an occupation for the amateur, for the idiosyncrasies of the plants are many. One must have the liking for exploration of the woods and bogs where the plants grow, and preferably gather the roots oneself. In no other way can the special requirements of each species or even each individual be studied and met.

E. O. ORPET.

The culture of epiphytal orchids in Florida.

The greatest trouble in the cultivation of epiphytal orchids on trees in southern Florida is in getting them completely established in their positions on the branches or trunks. In a natural state, the seeds of orchids, which are exceedingly fine, are carried largely by the wind and scattered over the trunks and branches. Those that alight in suitable places germinate and send their roots over the surface of the bark and in time become flowering plants. In artificial culture the plants already grown are placed on the trees, and unless this is done right and they have proper care for awhile, until they become established, but few will live and do well. Indigenous orchids are very abundant on the trees in the hammocks of south Florida, both species and individuals, there being known at present not less than twenty native species in this region. One of these, *Epidendrum conopscum*, ranges throughout the northern half of the state and into South Carolina, Georgia, and Alabama. Another species, *E. tampense*, is distributed over most of the peninsula, and these are endemic. The others are confined to the lower part of the state and are found in the American tropics.

Strong, healthy plants should be chosen and the potting material cleaned out from the roots as much as possible. The roots should be spread out, and a little sphagnum placed over them; then drive a small nail through a strip of mosquito-wire netting and into a tree where it is desired to place the orchid. Then place the roots of the plant against the tree close to the nail, adjust the strip tightly over them and nail through it into the tree on the other side. It may be best to put a second strip across, as it is absolutely necessary that the plant be firmly fastened, for if it is at all loose it never will do well. It should be watered at the time of planting and at intervals of a day or two, if the weather is dry, until it is established.

Orchids should be put on trees that have firm bark which does not scale off. Live oaks are ideal trees and red bay (*Persca carolinensis*) is good. They may be placed on smooth-barked trees but the rough-barked are preferable. Wild rats are often abundant and when orchids are placed on sloping or horizontal surfaces they destroy the plants; therefore, fasten the plants to vertical stems. They may be grown in high or low hammock or on cultivated trees; in fact, in any location where the air is not too dry or the plants are not too much exposed. They may be kept in pots of leaf-mold under a slat-house.

Sometimes orchids are attacked by what is apparently a fungous disease, which operates suddenly and fatally. The sheaths, pseudobuds or leaves at first become almost semi-transparent, looking as if they had been frozen; then they turn brown and the plants die. So far, dendrobiums have not been attacked but cattleyas and the thick-leaved oncidiums have suffered greatly. If noticed before the disease has progressed far, the sheaths of the leaves should be stripped off, the plant sprinkled with water and well dusted with sulfur, and if this is washed off by rain, applied again.

The coolhouse orchids have totally failed after repeated trials. But most of the cattleyas, the dendrobiums, oncidiums, epidendrums, lycastes, maxillarias, brassias and brassivolae, gongora, lœlia, miltonia, vanda, cyrtopodium and others have succeeded excellently. *Phalænopsis amabilis* and *P. Schilleriana* are succeeding excellently on trees in low hammock and bloom beautifully every winter. With cyrtopodiums, cymbidiums, phaius and some other terrestrial orchids in the hammock, the success has been only moderate.

Epidendrum tampense is an attractive native orchid and well worthy of cultivation; *E. nocturnum* and *E. cucullatum* are interesting; *Cyrtopodium punctatum* forms great masses on the trees and sometimes a single plant may bear 300 or more flowers. These are of considerable size and, with the scapes, are yellowish green variegated with red brown, a most striking and beautiful plant. *Oncidium luridum* and its var. *guttatum* are very fine, having immense heavy leaves and long branching spikes of brown-red and yellow flowers. These spikes or panicles curve gracefully and are sometimes 10 feet long. *Oncidium sphacelatum* is an epiphytial orchid that has become terrestrial or sub-epiphytial in its habit, growing wild on decaying logs, the bases of trees, or even in the soil of pine woods. It has tall panicles of bright yellow and brown-green flowers. The last seven species are natives of Florida, and all of them are doing well in cultivation.

There is apparently no reason why anyone may not have a few of these strange and beautiful plants anywhere in Florida. In the northern half of the state, the hardy Florida species and others of similar character from northern Mexico, Japan, north India or the cooler parts of South America can be successfully cultivated, while in the warmer part of the state a large proportion of the tropical species can be grown. They do well on trees in hammocks, in artificial groves and even on isolated trees where they are not too much exposed. Nothing is more entrancing than the cultivation of these strange, often weirdly beautiful forms. If one once becomes interested in orchids he is sure to be a confirmed lover of them ever afterward.

CHAS. T. SIMPSON.

Cultivation of the various kinds of orchids.

At this point are brought together, in alphabetic order, the leading orchid genera for instruction as to methods of cultivation. The list is prefaced with remarks on orchids in general and their cultivation, even though they cover some of the ground already gone over in the article by Robert M. Grey, which was contributed to the Cyclopædia of American Horticulture. The orchids are so special in their requirements that another experience will be valuable.

Orchid-culture has ever been that of the few who are students of plant life and who can give time and care to their plants. This statement has been exemplified by many professional men who have used this means as an alternative to their other cares, and find it all-sufficing since so many species require special treatment and some are never understood. If evidence were needed, it is proved by the fact that so many fine collections are dispersed after the decease of their owners, and that decadence is the usual result with plants that thrived well before passing into other hands. There was also the added interest that when buying imported plants, the flowering of many rare and valuable kinds resulted, which at times paid a liberal interest on the original investment. It is safe to assume now that we shall secure relatively few more new species of value from the native wilds, these having been searched to such an extent that few are the expeditions now made up in search of them.

The greatest impetus in orchid-cultivation today is

in the raising of plants by crossing and hybridization under conditions of cultivation, and the time is with us when we do not need to import either new species or plants of well-known forms. It is worthy of remark that the variation among orchids as we know them is such that no two plants are alike in the coloring or marking of the flowers. In the well-known *Cattleya Trianae*, or any other of the forms of the *C. labiata* group, each plant is different. Doubtless this is due to the fact that most orchids require insect agency for pollination. Usually each flower has a highly colored lip or labellum, to attract the insect, with radiating lines or tracks leading to the nectar and, when this is secured, it is impossible for the agent to withdraw from the flower without taking toll in the shape of pollen which, of necessity, is deposited on the next individual visited. In some orchids there are distinct keels on the lip, the track thus being emphasized and the bee compelled to take the narrow path that his mission shall be fulfilled.

It is often said that orchids need a well-marked period of rest. This is not always possible with specimens newly received from the wilds, as the flowering period has to be changed to accord with our winter or summer which in time governs their well-being. We will assume that the flowers have been pollinated by insect agency, and the seeds have matured. This maturation usually requires about a year. No one knows the number of seeds that will be contained in a healthy capsule. There must be tens of thousands, a very small proportion of which ever reach maturity when sown under glass; but here is apparently a reason for the time taken to ripen the capsule, that it may take place about the period for the plants to bloom again, which is presumably the most favorable or rainy season, and the seeds are distributed by the breeze to suitable media, and a proportion germinates and grows. We learn by sowing under glass that very few, even under the most careful treatment, ever live through the vicissitudes of initial stages, the tiny green globes or thalli having no true roots for months. It is perhaps a year after sowing the seeds before true roots are visible, but in the meantime, a hot drying day, if no gentle spraying of moisture is given, will blast all the hopes of many months' waiting; but we have the compensation of knowing that each plant we raise will be eminently fitted to survive under greenhouse conditions. The recent careful laboratory investigations have suggested rational methods of procedure in the growing of seedlings, and the subject will probably gradually pass out of the region of accident and doubt. (See page 2387.)

Variation that obtains among wild orchids is also present in various degrees among crosses and hybrids raised under cultivation. This was proved by the raising of over eighty plants of *Cattleya Thayeriana*, no two of which were alike, and some could not have been attributed to the same origin were it not for the connecting-links that rounded out the series.

In Europe, a great liking is shown for the coolhouse odontoglossums, especially since the raising of plants from seed has proved or illustrated the origin of many supposed species, the type flowers of which were sealed up for twenty-five years in Vienna in the herbarium of the late Professor Reichenbach who, in his day, was the dean of the orchid botanists, and whose collection was but this year uncovered. Following is a clause in Reichenbach's will: "My herbarium and my botanical library, my instruments, collection of seeds, etc., accrue to the Imperial Hof Museum in Vienna, under the condition that the preserved orchids and drawings of orchids shall not be exhibited before twenty-five years from the date of my death have elapsed. Until this time my collection shall be preserved in sealed cases. In the event of the Vienna Institution declining to observe these conditions, the collection falls under the same conditions to the Botanical Garden at Upsala.

should the last-mentioned institution decline the legacy, then to the Grayean Herbarium in Harvard University, Cambridge, Mass. If declined by that institution, then to the Jardin des Plantes, at Paris, but always under the same conditions, viz., of being sealed up for twenty-five years, in order that the inevitable destruction of the costly collection, resulting from the present craze for orchids, may be avoided." See Bailey, "Annals of Horticulture," 1889, with portrait, of Reichenbach, from "Gardeners' Chronicle." In the meantime, after the first lamentations, and the gathering of the available living types, cultivators began work with such authentic material as they had until now we have plants with three to four genera in their parentage, and the end is not yet. It will readily be understood that the recording and taking care of the nomenclature of these results as they occur week by week, is no simple matter, but it is being undertaken in such a way that for the present we know the origin of the many plants that have been raised. There is no other record in plant hybridization to compare with that of the orchids. In most cases, drawings have been made of the originals for filing in the archives. The Mendelian theory will surely find much material in the work of the orchid-cultivators, because of their painstaking in the matter of pedigree. It was early decreed that a plant without a pedigree could not be considered for recognition with a name. This seemed hard at times, because of special merit, but the cultivator had to be content with the result rather than with the honor. It is a curious circumstance that in the raising of orchids from seeds, many appear where they were not sown and in the most unexpected places. These are later placeable where they belong if there are other forms with which to connect them, but failing this there is no admitted reason for giving a name.

In past years, large prices were paid for forms of orchids that were unique, as for albinos, specially marked, or highly colored variations, all being imported forms. It was thought that these could be reproduced from seeds; this has not been true in most cases, even albinos having reverted to the normal and in most cases very poor forms. It is now a recognized principle that none but the very best varieties should be used as parents, and from these there are always a number of degenerates.

Orchid-hybridization is not prosecuted in America to the extent that it was at one time. It requires years to secure results that are obtained at far less cost in Europe, where the plants are more easily obtainable. We may mention a case in which nineteen years was required to flower a plant, the only one that survived from a certain cross, and when it bloomed it was of no value although true to its parents, one of which was of poor constitution.

General cultural requirements.

Most tropical orchids of cultivation are epiphytal, very few growing on the soil, and the requisite conditions are largely a matter of atmosphere,—not necessarily temperature. Heat is necessary, but only to be taken seriously in winter when it is generated artificially, sometimes from superheated pipes, which is always detrimental to the well-being of the plants. It is better to have a number of pipes heated to a moderate degree. In summer the heat is not a factor except with the cool Andean plants like the *odontoglossums*. If plenty of ventilation is given from the time frosts cease at night, one cannot imitate easily the night atmosphere outdoors, and the more the plants get of it when genial, the better they thrive.

Another factor under glass is shade from the sun. This must be governed by the amount of direct light admitted. It must be understood that a house running north and south will not get so much heat from the sun's rays as one built east and west. In a house hav-

ing full exposure to the sun in winter, orchids will need shading to some extent most of the winter, while one running north and south will not have to be shaded from the month of October until March. The plants are injured by the loss of green in the foliage due to exposure. Part of this will return when shade is given, but some of the older leaves will turn yellow and drop off. It is the medium course that conserves vitality, while ripening the growths perfectly, that the cultivator needs to bring about. The successful grower gives intensive study to each individual plant. We have had the experience of *miltonias* that thrived perfectly at the end partition of one structure, but never prospered when they were removed to other similar conditions. It was a question of exposure. So it is that cultivators often place a plant in a particular position in a house, seemingly the purest empiricism, but a practice not to be despised by those who want to succeed. It is not surprising that plants collected from the odd corners of the tropics, placed together in a small house where the temperature is to be maintained largely by artificial heat, require careful and individual study. With many difficult orchids, one cannot imitate the atmosphere of the Andes when the dog-days come, or when zero temperatures obtain outdoors and the wholesome atmosphere disappears by the exhaustion from superheated pipes.

Orchid-culture in America will be largely confined to a few genera, the "cool" kinds will rarely succeed, but those from Mexico to Brazil and most of the East Indian and Philippine kinds can be made to thrive better here than in Europe.

A number of American terrestrial orchids are amenable to cultivation. *Cypripediums* lend themselves kindly; and most of the others, as the *calopogons*, *spiranthes*, *pogonias* and *habenarias*, are plants essentially of the swamps or woods where moisture is secure all summer, but are not easily tamed in the usual way as are other plants, and yet their essential conditions may be met by the careful and thoughtful gardener.

The main cultural groups.

The orchid family is usually classified by growers into at least three divisions, for providing suitable temperatures and other conditions, especially atmospheric, although a closer analysis would make at least four cultural groups.

1. The warmest division should be kept at a minimum of 65° in winter, to take care of the *vandas*, *aërides*, *saccolabiums*, *phalaenopsis*, *angræcum*, *ancectochilus*, *habenaria*, a few of the strictly tropical *dendrobies* and other less known genera. Most of these may be termed extra- (or supra-) epiphytal for the reason that they secure most of their needed moisture through their large aerial roots, the material that they are planted in being secondary in importance as a source of nourishment. There are many *cypripedes* that need this warm treatment, such as the Malayan, Bornean and some of the East Indian species, for they speedily resent being chilled. The higher temperature makes the cultural details in winter more difficult to regulate since moisture must be kept up to counteract the dry heat from the pipes; therefore it is always best to have a number of pipes moderately warm rather than a few superheated. Insect pests are also more persistent under superheated conditions. Thrips and red-spider are harder to fight, and must be kept down by frequent light sprayings with approved insecticides containing nicotine, applied with an atomizer once a week in case of an invasion. Troughs on the heating-pipes for the evaporation of water are essential, and sometimes, in large structures, open tanks are used under the stages on which the plants stand filled with water which is heated by coils. Too much emphasis cannot be placed on the keeping of a proper atmosphere as well as heat for these tropical plants. This can be brought about

by proper ventilation and shading from the hot sun, to prevent the escape of the atmosphere when it has been secured. Most of the foregoing orchids are natives of the tropical jungles where shade is ever present, and exposure suddenly after a few dull weeks to the hot rays of the sun under glass in early spring will do harm.

2. The temperate division is the home of by far the largest number of the cultivated orchids. A night heat of 50° in winter as a minimum on extreme cold nights will be better for the plants than a higher temperature. It is well known that, after a period of severe cold, many of the older leaves of cattleyas turn yellow and fall off, a sign of the stress to which they have been subjected. In moderate weather, 55° will be better, especially if plants are in bloom. In addition to the cattleyas, the lœlias, cymbidiums, sobralias, oncidiums, stanhopeas, epidendrums, brassias, miltonias, catasetum, phaius, the Mexican odontoglots, and East Indian dendrobates, and many cypripedes, will thrive best in the temperate house. If but one house or division is to be devoted to orchids, this should be an intermediate one for the reason that, with the exception of the purely tropical species and the coolest Andean, the greatest number can be cultivated therein by the careful utilization of the various parts of the house for individuals that need the warmer or cooler end or a little more shade, conditions that are soon discovered by the observant cultivator. The admission of fresh air when weather permits is of the utmost importance. In summer the house should have free air day and night from the first of May until late September. It is the greatest factor in building up the plants after the exhaustion of flowering. At this time, watering should always be performed in the late afternoon; and if watering is not necessary, spray the plants overhead after each very hot day. In winter, water is best given in the morning that the surplus will dry off before night.

3. A coolhouse is necessary for the Andean odontoglots, cochliodas and their now numerous hybrids, the sophonitis, disas, masdevallias, *Calogyne cristata*, *Epidendrum vitellinum*, lycastes, and a few other plants. These are among the most charming of all orchids, the odontoglots especially. Difficult as the odontoglots are to manage, much success has been attained by care and suitable structures, preferably with a north slope with the shade of some other building to the south. Roller shades on the coolhouse should be kept about 12 inches above the glass roof to admit of a free circulation of air beneath in hot weather, with ventilators at the top and bottom near the pipes. Cool orchids require to be kept moist all the time. There is no very marked period of rest, as they are subject to heavy night dews where they grow; but in the dull winter months, all the sunlight must be admitted, as most of the active growth is made in winter and early spring. These plants are a real test of the skill of the grower. A few cool summers build up the plants so they flower well and it has been noticed that the best results are obtained in the cooler parts of the country, or near the seashore.

Further suggestions; propagation.

Many genera in cultivation are seldom seen in collections here, but a knowledge of their native habitat, and especially the elevations at which they grow, must be the clue to their needs in cultivation, together with a study of their root-system. The roots that are white, are aerial, and those that have root-hairs are terrestrial, and being of the earth will best be treated as pot-plants.

Many species are easy of propagation by division, and it is often advisable to divide plants rather than grow them on into large specimens. The plants should be kept in reasonable size. Propagation by means of seeds is a slow process, and in many cases one cannot be sure what will come true from seed. Even from well-marked types there is always the possibility of rever-

sion. Especially is this the case with albino forms, so many of which occur among imported specimens.

Cultivation of leading genera of orchids.

Acanthophippium. For culture, see *Acanthophippium*.

Acineta. For culture, see *Acineta*.

Ada. A small genus of few species with bright orange-colored flowers that add color to the coolhouse among the odontoglots, and require similar treatment.

Aërides. True epiphytes that revel in a moist atmosphere in a warmhouse with a winter minimum of 65°. Very little potting material is desirable, just enough to anchor the plants in the pots. The roots made from the stems as the plants grow seem to gather the needed nourishment, and care must be taken not to injure these or check them, as they are very active, even in winter. Some of the species are very fragrant, all are beautiful and last a long time in bloom. A surfacing of moss should be added to a thin layer of osmundine, and the drainage made up of large pieces of charcoal and crocks. Basket-culture is often adopted, but it is hard to re-basket without injuring the roots, but the old material may be removed, the roots washed and new added each year until new baskets are necessary by reason of decay.

Aganisia. Warmhouse plants, needing little material about the roots, and to be suspended near the roof glass with a maximum of light but no direct sun in summer.

Angraecum. Culture as for *Aërides*.

Anguloa. Culture as for *Lycaste*.

Anæctochilus. Terrestrial tropical orchids with creeping root-stems, foliage beautifully marked, the Malaccan name being "written flower" owing to the marking resembling hieroglyphs, done in many colors. These plants are best grown in the warmest part of the structure, in a small frame or under bell-glasses to keep the leaves unspotted and ensure uniform heat and moisture, but some air must be given to guard against condensed moisture and consequent drip. Difficult to import and not often seen in collections.

Ansellia. A tropical African genus of a few species growing on trees, where there is a climate of abundant moisture during the growing period, with a dry season of about half the year. Culture in the warmhouse, withholding water to ripen the growths well after they are completed.

Arachnanthe. Culture as for *Aërides*.

Arpophyllum. A temperate house genus seldom seen in cultivation, coming from high altitudes in Mexico and Guatemala, best grown in baskets, in shade and plenty of moisture. Culture same as for *Lycaste*.

Aspasia. Once considered as *odontoglossums*. There are about eight known species, seldom cultivated, requiring treatment as for odontoglots.

Batemannia. Plants that are never at rest, needing a moist tropical atmosphere, with no appreciable resting as water is needed all the time. Very little material is needed at the roots, and this kept in a sweet healthy condition by adding new material and the removal of old portions. Red-spider must be kept away by frequent washing of the foliage.

Bifrenaria. Brazilian plants requiring treatment same as cattleyas from that region, and a trifle warmer position than those from Colombia.

Bletia and *Bletilla*. Cool terrestrial plants, but not hardy. Can be grown in an ordinary greenhouse and kept dry in winter when at rest, repotting in fresh material when growth begins in spring.

Bollea. Culture as for *Batemannia*.

Brassavola. Best known by reason of *B. Digbyana*, which is so much used by the hybridist to put the fringed lip on cattleyas and lœlias, with which it can be combined readily. Of culture the same as for cattleyas, slow to increase by division, but otherwise easy of culture.

Brassia. These are seldom seen in modern collections, but were old-time favorites, growing and flowering freely in an ordinary structure with no special care, and may well be associated with the warm oncidiums as to potting and subsequent routine.

Broughtonia. The only species known in cultivation here, *B. sanguinea*, is hard to cultivate for any long period. It is best attempted on a portion of osmunda rhizome, with a little moss at the roots, hung near the glass in the warmhouse.

Bulbophyllum. Among these are the giants among orchids. Some species attain huge size, require tropical treatment in a steaming atmosphere during growth and the flowers when produced are remarkable, though very seldom seen except in botanic gardens. Some species are small and require to be grown on blocks of wood; increased by division.

Calanthe. Deciduous bulbs that need rest after the flowers are cut in midwinter, until there are signs of growth in spring, then shaken out to be potted in turfy loam, a little well-decayed manure, in pots or pans with good drainage. The warmest position or shelf with shade will best suit calanthes. It might be said they will enjoy a little fire heat every day in the year, with proper shade and plenty of moisture. The long flower-scapes begin to develop in late summer, and when these appear liquid nourishment must be given frequently to grow large bulbs. The flower-scapes are long, last a long time in perfection when cut, and as the flowers open, cooler and drier treatment may be given. Increase is readily made by means of the old bulbs that will often grow again, and these often double in number each year. A valuable florists' orchid when its culture is understood, and profitable to grow.

Calopogon. For culture, see *Calopogon*.

Camarotis. Culture as for *Aerides* and *Vanda*.

Catasetum. Curious and beautiful orchids from Central America, that often have the two sexes in different individual plants, a fact that was long a puzzle to botanists, and the peculiar structure of the flowers makes the plants very interesting. The culture is not easy in gardens; plants usually dwindle after a few years, but plenty of heat and light when in growth, with a long resting-period between, is necessary, and growth is best when the plants are suspended from the roof.

Cattleya. The most popular and best known of the orchids grown for cut-flowers, with few exceptions. Best grown in the intermediate house. For culture, see *Cattleya*.

Chysis. Culture as for *Vanda*.

Cirrhopetalum. For culture, see *Cirrhopetalum*.

Cleisostoma. Culture as for *Aerides*.

Cochlioda. A genus much prized by hybridizers of late for the color it imparts to the odontoglossums, the hybrids of which are now known as *Odontioda* and form a pretty rose-colored series of cool orchids, very popular where they thrive. Treatment same as for odontoglossums.

Caha. Culture as for *Epidendrum*.

Calogyne. Terrestrial orchids, both temperate, as *C. cristata*, and tropical, as *C. Massangeana* and *C. pandurata*. Species like the last two need basket culture suspended, as their flower-spikes are dependent. The well-known *C. cristata* will do well in a coolhouse when at rest before flowering, soil containing a portion of earth, and liquid manure during growth is necessary to produce strong flowering growth, increased by division directly after flowering period.

Colar. Culture as for *Lycaste* and *Zygopetalum*, in an intermediate house.

Compertitia. Culture as for *Broughtonia*, but in an intermediate house.

Coryanthes. Culture as for *Stanhopea*.

Cynoches. Curious Central American plants, often called the "swan-neck orchid," requiring treatment identical with that of *Dendrobium*, and well-marked resting-period after growth is completed.

Cymbidium. Decorative evergreen tall-growing plants that have many flowers of long duration. All are from the East Indies, but do well in an intermediate and even a cool house in winter. They also do well when planted out among rockwork in large structures, and the hybridist has added very many fine plants that go to make up the collection in gardens. A soil with loam added and manure-water added frequently when the plants are growing or rootbound will induce strong growth. The plants are impatient of disturbance at the roots, but if carefully done they may be increased by division. Seeds germinate freely. For further cultivation see *Cymbidium*.

Cynorchis. Terrestrial plants from Madagascar and Natal. Culture same as for *Bletia*, repotting in fresh material in spring.

Cyperorchis. Culture as for *Cymbidium*, to which genus they are sometimes referred botanically.

Cypripedium. Terrestrial orchids, although sometimes growing on rocks with little humus about the roots, including tropical or warmhouse plants (now referred to *Paphiopedilum*), these being often with mottled foliage; intermediate house plants as *Paphiopedilum insigne* and its many hybrids, and the hardy species, always deciduous and widely distributed. *Cypripediums* are herbaceous, having no pseudobulbs, and should never lack for moisture or be overpotted. Propagation by division or seeds, which germinate freely. Albino forms have been reproduced by seeds, to a large degree true to the parent plant; also specially fine varieties.

Cypripodium. Culture same as for *Cynoches*, repotting in spring; carefully shade the young foliage until mature. Flowers are produced with the commencement of young growth in spring. Avoid spraying over young growths, as water lodging often induces decay unless the house is well ventilated and the day bright.

Dendrobium. For culture, see *Dendrobium*.

Diacrium. Culture as for *Epidendrum* and *Cattleya*.

Dia grandiflora. An orchid from Table Mountain, is now protected by the state, owing to its scarcity due to collectors, is a very beautiful plant when in bloom, but it is doubtful whether it has ever been cultivated here with success, though not difficult to handle in European gardens, where it is easily raised from seeds and by division. It is strictly terrestrial, but seems unable to bear heat. There are several other species and many hybrids from these, but none seems amenable here.

Epidendrum. A genus of very much varied plants, some being stem-rooting and without bulbs, and these require all the sun to flower freely; others have pseudobulbs, are easy of culture and do well in the intermediate house, with treatment same as for *Cattleya*. For further culture, see *Epidendrum*.

Eriopsis. Culture as for *Lycaste*, in shallow baskets suspended in an intermediate or cattleya house. Repot when growth commences, with great care, as the plants are impatient of root-disturbance. *E. ruticubulum* is the best known species, but it is very rare even in its native Antioquia.

Eulophia. Culture as for *Calanthe*.

Galeandra. Culture as for *Calanthe*.

Gomesa. Culture same as for *Broughtonia*. A Brazilian genus, species of which are rarely seen in cultivation, being largely of interest in a botanical way.

Gongora. Requires to be grown in baskets suspended, as the flower-spikes are produced from the base of the plant downward. No obstruction by way of drainage should be allowed to hinder these. An intermediate treatment, with less water when resting will

suit the plants. They are seldom seen, as the flowers have no bright coloring to attract, though some are very fragrant.

Grammangis. For culture, see *Grammangis*.

Grammatophyllum. For culture, see *Grammatophyllum*.

Habenaria. Both tropical and temperate species are included. The plants are always deciduous and the warm species need resting until new growth commences, then careful repotting in new material. A warm shady corner suits their needs best. The hardy species are found in both the Old World and New, growing in moist rich soil with partial shade, but sometimes in full sun in marshy land.

Hæmaria. For culture, see *Hæmaria*.

Hartwegia. Rarely seen. Culture as for *Gomesa*.

Houllettia. Culture same as for *Stanhopea*, in intermediate house, kept rather dry in winter, using baskets.

Huntleya. Culture as for *Batemannia*.

Ionopsis. For culture, see *Ionopsis*.

Isotria. Culture as for *Pogonia*.

Lacana. For culture, see *Lacana*.

Lælia. For culture, see *Lælia*.

Læliocattleya. For culture, see *Cattleya* and *Lælia*.

Leptotes. Culture as for *Lælia*.

Limnolobos. For culture, see *Limnolobos*.

Liparis. For culture, see *Liparis*.

Lissochilus. A tropical African genus, requiring soil similar to phaius, made up of part good loam, with a little old manure, sand, and plenty of drainage. In Africa the plants are sub-aquatic, and have been cultivated with water-lilies. This is not generally practised, however. The flower-spikes sometimes attain 12 feet in height in *L. giganteus*. The warmest house is necessary, with frequent applications of liquid manure during growth with somewhat drier treatment in winter until new growth begins. Shade in summer is necessary as the foliage is thin when new.

Listrostachys. Culture same as for *Angraecum* or *Phalenopsis*, in very shallow pans as the plants are small.

Luisia. For culture, see *Luisia*.

Lycaste. Semi-terrestrial orchids requiring intermediate treatment with shade from direct sunlight at all times as the foliage is thin and easily injured. In Africa the plants are often grown in baskets suspended, but should be kept moist at all times as flowers are produced at various seasons, and growth is often being made during the whole year. A portion of loam in the soil, or the heavier grade of osmundine is best suited to the roots of orchids of this nature. Propagation by division.

Macodes. Culture as for *Anæcethilus*.

Masdevallia. Of all Andean orchids these do the best in an ordinary coolhouse when shaded from sun, and watered frequently, for, having no pseudobulbs, there is no reservoir to draw upon. The colors of most *masdevallias* are wonderful, and the plants easy of culture in the usual orchid material. Increase is readily made by division of the stems just after flowering, being careful to save the roots intact. For further cultivation, see *Masdevallia*.

Maxillaria. Once a very well-known genus of free-flowering orchids of easy culture, some species being fragrant, but of late, owing to the small flowers and dull coloring, the plants have disappeared from collections with the possible exception of *M. Sandersoniana*, which is an exception as to coloring, it being attractive and the flowers large. Treatment as for *Lycaste*, and propagation by division.

Mesospinidium. Culture as for *Cochlioda*, to which it is closely allied.

Microstylis. For culture, see *Microstylis*.

Miltonia. These were long known as odontoglossums, and *M. vexillaria* is one of the prized orchids today. It is a little particular as to position in the house, needing plenty of sun during the winter, which is the period of growth. After flowering, in May or June, there is a short time of rest, when the plants are much weakened and need careful nursing with shade to enable them to recuperate and make strong growth again. *M. Roezlii* is very similar, but is a warmhouse plant requiring 10° more heat, and flowers in winter. These are the two best known species, but, with the exception of *M. Roezlii*, all need the intermediate house. Propagation is by division when growth is starting, at potting time.

Mormodes. For culture, see *Mormodes*.

Mysticidium. Culture as for *Angraecum*.

Odontoglossum. A very popular genus in Europe, but difficult to grow well here owing to the extremes of temperature. Natives of the Andes, where the temperature does not vary 10° winter or summer. Some success has been attained here, especially during cool summers. For culture, see *Odontoglossum*.

Oncidium. There are a large number of species, ranging from the alpine Andean small-growing ones to large tropical plants. No genus of orchids presents such wide variation and study. Their culture is easy when the needs of the individuals are studied, and these are governed by the elevation at which the plants are found growing and imitating as well as can be the temperatures. Some of the cool species need moisture all the time, while the Mexican and Central American ones do best with a defined period of rest, meaning less moisture and heat, generally in the winter, sometimes before flowering and often after. The intermediate house will suit all except the cool ones. The flower-spikes are often very long, as in *O. macranthum*, and need careful training to keep away from the glass. *O. Rogersii* is perhaps the best known and is a popular florist's winter-flowering orchid imported annually in quantity. The usual potting material is suitable, but *oncidiums* seem to do best when restricted as to root-room.

Ophrys. Culture as for *Habenaria*.

Palumbina. Closely allied to *oncidium*, and sometimes included. Culture as for the intermediate house *oncidiums*.

Paphinia. For culture, see *Paphinia*.

Paphiopedalum. For culture, see *Paphiopedalum* and *Cypripedium*.

Peristeria. A tropical orchid requiring much the same treatment as *calanthe* when growing, but the *peristeria* does not need such a marked period of rest, as it is evergreen. It is terrestrial, requiring a loam mixed with old manure, and liberal supplies of moisture. If black-spot disease appears, it must be cut out at once and the cavity filled with lime and sulfur. This disease seems to be common. The tall spikes of sweet-scented flowers, the center of which resembles a dove, are much admired and last long in perfection.

Pescatoria. Culture as for *Zygopetalum*.

Phaius. Eastern tropical plants of great beauty, one of which has become naturalized in the West Indies. Terrestrial in habit, needing a soil composed largely of loam rich with humus, and liberal feeding when in full growth. Propagated by division, after flowering.

Phalenopsis. Tropical epiphytes needing the warmest temperature admitted in orchid-culture, which is a minimum of 65° in winter and this in the coldest weather, and an atmosphere never allowed to become arid or stagnant. At some seasons drip from above easily proves fatal. Very little material is needed at the roots, as they love to escape the receptacles when doing well and hang pendent. Osmundine is the most suitable material to use as it is lasting, but where sphagnum will live and keep green it is well to use it as an index to the need of moisture. Many growers never spray *phalenopsis* overhead, water in the center of the plants often causing decay, but in very hot weather this will evaporate by the addition of air. Having no pseudobulbs, but a pair or more of large leaves to support, the plants must never lack moisture. The flowering period is mostly in winter or early spring and the beautiful sprays of bloom are now a large item among growers for market since the plants can be so readily obtained from the Philippines. There is a tradition that *phalenopsis* do best near the coast. Certain it is, that California growers are having great success with them.

Pholidota. For culture, see *Pholidota*.

Phragmipedium. For culture, see *Phragmipedium*.

Phystris. From Colombia, but with foliage similar to the *anacardium* from the Malay Archipelago. *Phystris* grows at an elevation of 5,000 to 6,000 feet and will thus be best treated in the same house with the *odontogloss*. One species occurs in Peru.

Platylis. Warmhouse plants, all of which have fragrant flowers, and are easy of culture. The best known is *P. glumacea*, but *P. filiformis* is sometimes seen. Easily grown in osmundine and propagated by division.

Platone. A pretty genus of East Indian plants known there as the *crocus*. Flowers mostly pink, and produced after the foliage has died down. Best grown in shallow soil in pans, with treatment as for *calanthe*.

Pleurothallis. Small-growing plants of great interest botanically but many have flowers that require the aid of a microscope to see their beauty. Best grown in the cattleya house in shallow pans suspended near the glass. They need moisture at all times but very little material at the roots. In summer the plants may be placed with the *masdevallias*, at the warm end of the *odontoglossum* house.

Pogonia. Hardy orchids found in wet soil with very showy flowers, but difficult to transplant unless plenty of earth is taken with the roots.

Polystachya. A tropical African genus, rare in cultivation.

Promenac. Culture as for *Zygopetalum*.

Ranthera. Culture as for *Vanilla*.

Restrepia. For culture, see *Restrepia*.

Rhynchostylis. Culture as for *Saccolabium*.

Rodriguezia. For culture, see *Rodriguezia*.

Saccolabium. Culture as for *Aërides*. See also under *Saccolabium*.

Sarcanthus. For culture, see *Sarcanthus*.

Sarcopodium. A genus separated from *Dendrobium* and *Bulbophyllum*, and requiring treatment similar to that of *Dendrobium*.

Scaphosepalum. For culture, see *Scaphosepalum*.

Schomburgkia. Culture same as cattleya, but requires to be well ripened by exposure to more sun, especially in winter, to induce flowering. The plants are seldom seen, as they are large, and the flowers inconspicuous by comparison with other orchids, borne on stems sometimes several feet long.

Scuticaria. For culture, see *Scuticaria*.

Serapias. For culture, see *Serapias*.

Sobralia. A group of reed-like plants, flowering at the end of new shoots, several large cattleya-like flowers coming in succession, but, these being short-lived, are of no value commercially, but are interesting plants in a collection. Specimens may be grown to a large size and the plants do not deteriorate. Many hybrids have been raised, but are seldom seen in gardens. Propagation by division usually, and a soil as named for *calceogone*.

Sophronitis. A brilliant-colored little orchid, an alpine plant. Easy of culture in shallow pans suspended near the roof. *S. grandiflora* is the best known, and has been much prized for imparting its color to the larger cattleyas and *kelias*. At least one hybrid has been raised here, and many more in Europe and Britain. The color is usually equally brilliant in secondary crosses. Does best in the cattleya house and should never become dry at the roots or the plants will suffer.

Spathoglottis. For culture, see *Spathoglottis*.

Spiranthes. Hardy native orchids popularly known as "ladies' tresses." Easily transplanted, but seem to flower biennially, late in summer and early autumn.

Stanhopea. Treatment similar to *gongora* with similar pendent flower-spikes through the bottom of basket. Flowers very striking in color and odor, but do not last long.

Stenorynchus. Tropical plants allied to *spiranthes*, with variegated leaves and colored flower-stems. Treatment same as for *Paphiopedalum*.

Thunia. Tall-growing bamboo-like stems with clusters of flowers at the top. Very attractive but not often seen owing to the attacks of red-spider on the thin foliage. After flowering, the plants need resting, being kept dry but in a warm house, until growth starts again. Propagation is by cutting the stem in pieces with several joints, laying on damp moss in a propagating-case in strong heat until roots are visible, then potting and treatment as with older plants. Loam should be added and weak liquid manure-water when rapid growth is produced.

Trichocentrum. For culture, see *Trichocentrum*.

Trichosma. Only one species seems to be in cultivation, *T. suavis*, a very pretty fragrant-flowered orchid, needing intermediate house treatment, with culture same as for *cypripedium*, repotting to be done in winter after flowering season has past.

Tropicilia. Beautiful and fragrant orchids, free-flowering, needing same culture as *lycaete*.

Vanda. Culture as for *Aërides*. See also under *Vanda*.

Vandopsis. Culture as for *Vanda*.

Vanilla. Tropical epiphytes producing a valuable bean-like capsule and the only orchids known that have a commercial value apart from the flowers. They are true epiphytes, requiring support such as a wall at the end of an orchid house where moisture is assured for the creeping roots. Pollination must be done by hand to be sure of pods being formed. The culture of vanilla is carried on on a large scale in the tropics, but it is impracticable under glass. Easily propagated by cutting up the rooted stem into pieces.

Warrea. Culture as for *Phaius*.

Warszewiczella. Culture as for *Zygopetalum*.

Zygopetalum. Very decorative winter-flowering plants, *Z. Mackayi* being of easy culture, and perhaps the only species well known. It is very free-flowering, fragrant, will seed freely and produce plants true even though hybridized by other pollen, even unto the fourth generation. It is one of the oldest known orchids, requiring soil similar to *phaius* and an intermediate treatment.

E. O. ORPET.

ORCHIS (Greek word, referring to the shape of the tuberous roots of certain species). *Orchidaceæ*. The typical genus of the great family of orchids.

Plants perennial by means of simple or palmate tubers: st. simple, erect, terminating in a raceme or spike, with few to many rather small fls., and bearing several lvs., with long sheaths: bracts often foliaceous: sepals all similar, connivent or spreading; petals often smaller, entire; labellum 3-lobed, middle lobe entire or parted, base spurred; column very short or none; stigma plane, not produced (*Habenaria*).—About 70 species, all terrestrial and natives of the northern hemisphere, chiefly in Eu. and Asia, with 2 species in N. Amer. For *Orchis spectabilis*, Linn., see *Galeorchis*.

Orchises are not showy, and they have no horticultural standing, but lovers of hardy orchids collect them and try to cultivate them, usually with little success. They will probably thrive under the treatment given *Galeorchis*, of which F. W. Barclay writes: "The American species of *Orchis* are woodland plants, requiring rich leaf soil, with rather heavy shade, and that even condition of moisture characteristic of deep woods. Where these conditions cannot be supplied, the plants invariably prove short-lived." See also discussion on terrestrial orchids, page 2392.

hircina, Crantz (*Himantoglôssum hircinum*, Spreng.). Fl.-sts. 1-2 ft. high, bearing a loose raceme 4-8 in. long; fls. greenish white, exhaling a disagreeable odor; middle lobe of the labellum long, strap-like and twisted, lateral lobes much smaller; lvs. few near the bottom of the scape, oblong-lanceolate. May, June. Eu. and N. Afr. G.W. 2, p. 351.—Advertised by Dutch bulb-growers.

The following species are advertised in Amer. by European dealers, but are not known to be cult. in Amer. Most of them are hardy European plants. The synonymy of the group is somewhat confused. *O. Brancifortii*, fl. purple.—*O. foliolosa*, large, leafy spikes of purple fls. G. 13:183; 26:296; 35:465. G.M. 50:709.—*O. fuscâ*, purple, and rose-colored fls.—*O. latifolia*, spotted lvs. and purple fls. G. 6:229. G.W. 20:599.—*O. longicôrnis*, fls. rich purple. N. Afr.—*O. maculâ*, fls. lilac-purple.—*O. musculâ*, fls.

purple, in long spikes.—*O. militaris*, fls. purple.—*O. Môrio*, fls. purple and green.—*O. pallens*, pale sulfur-yellow.—*O. papilionacea*, fls. purple and white.—*O. provincialis*, long spikes of pale lemon-yellow fls.—*O. Robertiana*, fls. purple, brown and white, in large spikes.—*O. sambucina*, fls. yellow.—*O. undulatifolia*, fls. white- and rose-colored.

HEINRICH HASSELBRING.

OREOCARYA (Greek, *mountain nut*, referring to habitat and the nutlets comprising the fr.). *Boraginaceæ*. About 20 species of mostly biennial rough or hispid herbs separated in recent years from *Eritrichium* and *Krynitzkia*. They are natives of W. N. Amer. and Mex. They are scarcely known as horticultural subjects, as only now and then are some of them transferred to gardens. They are white- or yellow-fl., the blossoms being on the order of *myosotis*: lvs. alternate, narrow; roots woody; fls. in crowded thyrse-like or panicle clusters, the calyx 5-parted; corolla salverform, crested in the throat, 5-lobed; stamens 5, not exserted, often dimorphic; ovary deeply 4-lobed, becoming 4 nutlets. Many species are native in the Wyo.-Colo.-Utah region. L. H. B.

OREOCÈREUS (the mountain *Cereus*). *Pilocèrus* in part of authors. *Cactaceæ*. Usually large columnar plants with strong armaments and producing long white hairs or wool like *Cephalocereus*, but with very different fls.: ovary and fl.-tube covered by numerous imbricating bracts with their axils filled with long woolly hairs; stamens numerous, as long or longer than the petals; style long exserted.—Two species are in cult. and are described below. They are cult. the same as *Pilocereus*.

Celsianus, Riccob. (*Pilocèrus Celsianus*, Lem. *P. fossulatus*, Lab.). Columnar, in the gardens simple, hardly more than 4 ft. high, 3 in. diam.: ribs 10–17, bright green: areoles bearing long (2 in.) white hair; radial spines usually 9, the lower one, the longest, less than 1 in. long; central usually 1, sometimes 4, the longest sometimes 3 in. long, all yellow: fls. not known. Andes of Bolivia.

Var. *Bruénnowii*, Brit. & Rose (*Pilocèrus Bruénnowii*, Haage, f. *P. Celsianus Bruénnowii*, Schum.). St. stouter: wool brownish, more copious; spines stronger and darker.

Ianatus, Brit. & Rose (*Cactus lanatus*, HBK. *Pilocèrus Dauteritzi*, Haage, f. *P. Haagei*, Poselg.). Columnar, reaching 5 ft. in height, 4 in. diam.: ribs 25–30, low, obtuse: areoles close together, bearing over 20 needle-like, spreading and interlocking spines, and also copious long, white, curled hairs which cover the whole upper part of the plant, like a spider's web.: cephalium and fl. not certainly known. N. Peru. Ecuador. G.C. 1873:7. F.S. 21:2163.

J. N. ROSE.

OREÓCOME: *Selinum*.

OREODÓXA (Greek, *mountain glory*). *Palmaceæ*. The royal palm, cabbage palm, and a very few others, from Florida to northern South America, comprising the finest species of palms in cultivation; pinnate-leaved, with tall columnar boles.

The genus *Oreodoxa*, as formerly understood, has recently been divided, and the Florida and West Indian royal and cabbage palms have been separated

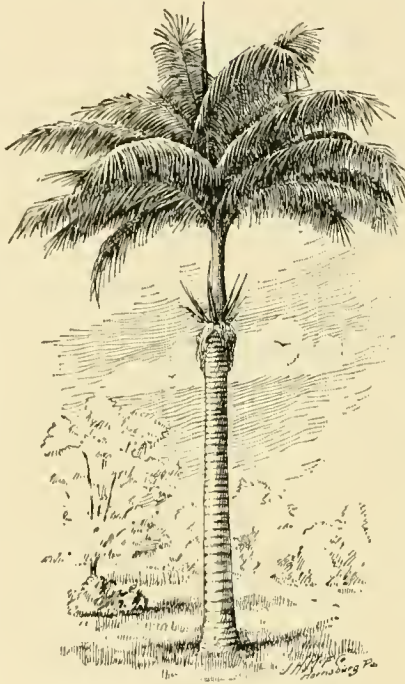
as *Roystonea* and the name *Oreodoxa* has been reserved for South American species. This separation proceeds on the basis of the botanical distinctness of the two groups and also for nomenclatorial reasons. *Oreodoxa* was established by Willdenow in 1804 for 2 Venezuelan species, neither of which is congeneric with the W. Indian royal palms. The type species, *O. acuminata*, Willd., is associated by some authors with *Euterpe*, by others with *Enocarpus*. (See O. F. Cook, *Science* II. 12:479 (1900); Bull. Torr. Bot. Club, 28:549 (1901), and 31:349 (1904); also Cook & Collins, *Ee. Pl. Porto Rico*). Nevertheless, this disposition has not been accepted by other palm students, as Beccari, and Dammer & Urban; and until something like an agreement is reached (and without expressing any opinion on the merits of the case), it is better for a cyclopedia of horti-

culture to hold to a conservative practice. For Beccari's recent treatment, see *Pomona College Journ. Econ. Botany*, May, 1912.

As usually defined, and as understood by Martius (not Willdenow), *Oreodoxa* comprises spineless palms, the solitary erect robust trunk cylindrical or swollen at the middle: lvs. terminal, equally pinnatiseet; segms. narrowly linear-lanceolate, narrowed at the apex, unequally bifid; midnerve rather thick, scaly beneath; margins not thickened, recurved at the base; rachis convex on the back, sulcate toward the base, and acute toward the apex above; petiole half-cylindrical, sulcate above; sheath long: spadix rather large, with long, slender, pendent branches; spathe 2, the lower broad, laterally earinate, shorter than the spadix, the upper complete semi-cylindrical, ventrally fissured; bracts and bractlets scaly: fls. small, white, in scattered glomerules: fr. obovoid or oblong-ovoid, small, violet; seed small, rounded, depressed, or obovate and somewhat curved, with sub-basal embryo and uniform albumen.

The two well-known *Oreodoxas* are the royal palm (*O. regia*) and the cabbage palm (*O. oleracea*).

Both are stately trees. While it is often difficult to distinguish immature specimens of the royal and cabbage palms, in age they are distinct. *O. regia* has staminate flowers which, in bud, entirely inclose the stamens, while in *O. oleracea* the stamens protrude before the flower opens. In the latter species, also, the fruit is nearly twice as long as wide, while in *O. regia* it is not more than a third longer than wide. The character of trunk swelling, usually applied as a distinguishing mark, is likely to break down in some wild plants. The royal palm is one of the grandest of pinnate palms, growing to a height of over 100 feet with immense plummy feathery leaves and a straight white trunk. It is a magnificent tree for extreme southern Florida for avenue planting, and is valuable in all sizes, but especially when 4 feet or over in height. The form of it native in Florida is by some regarded as a distinct species. The cabbage palm is cut down when three years old for the central leaves, which are tender and edible. In southern California, the royal palm lives for years but without attaining any size, and is therefore not accounted a success there. Because of the original error in assigning the West Indian royal palms to *Oreodoxa* of Martius, which itself is untenable, the names of these plants and their relatives are badly mixed.



2675. Royal palm.—*Oreodoxa regia*.

A. *Staminate fls. bearing columnar pistillodes that are 3-parted at the apex (Oreodaxa).*

Sancóna, HBK. St. 120–150 ft., smooth, glabrous, grayish black; lvs. pinnate; lfts. membranaceous; wood very hard, used in building houses. Colombia.—Apparently cult. only in S. Calif. within the U. S. Franceschi says it has brownish fl.-stalks and is more tender than *O. regia* or *O. oleracea*.

AA. *Staminate fls. bearing spherical or ovoid pistillodes with sessile stigmas (Roystonea).*

B. *Trunk usually swollen at or above the middle.*

régia, HBK. (*Roystonea régia*, O. F. Cook). ROYAL PALM. Fig. 2675. Caudex 40–60 ft. high; lvs. 8–10 ft. long; lf.-segms. $2\frac{1}{2}$ ft. long, 1 in. or less wide, linear, acuminate; fr. ovoid, $\frac{1}{2}$ in. Cuba, Antigua. G.F. 9:155. S.S. 10:505. G.C. III. 17:239; 27:297. A.F. 12:311. G.M. suppl. Oct. 1, 1892.—Commonly planted in the W. Indies; also elsewhere. The form in Fla. (separated as *Roystonea floridana*, O. F. Cook) is said to lack the characteristic bulge in the trunk and to grow in reach of tide-water rather than on the hills or elevated lands. In the Everglades this native palm sometimes reaches 125 ft. in height, with lvs. 15 ft. long. It is tall and slender when young.

Borinquena, Reasoner (*Roystonea Borinquena*, O. F. Cook). The ROYAL PALM of Porto Rico. Trunk usually with a prominent bulge, but sometimes slender, about 30–35 ft. tall; otherwise much as in *B. regia* but differing in having more densely branched infl., which is covered with a dark brown pubescence: seeds about $\frac{1}{2}$ in. long, distinctly narrower than those of *O. regia* and somewhat flattened or concave on the back. Porto Rico, on limestone hills.—According to Reasoner it does well in extreme S. Fla. outdoors.

BB. *Trunk not swollen at the middle, usually perfectly cylindric.*

oleracea, Mart. (*Arëea oleracea*, Jacq. *Eutérpe Caribæa*, Spreng. *Roystonea oleracea*, O. F. Cook). CABBAGE PALM. Caudex 100–120 ft. high; lvs. 10–14 ft. long; lf.-segms. lanceolate-linear, acuminate, 3 ft. long, $1\frac{1}{2}$ in. wide; fr. obovoid-oblong, $\frac{3}{4}$ in. W. Indies.—Cult. in S. Fla. L. H. B.†

OREÓPANAX (i. e., *mountain Panax*). *Araliææ*. Tropical American shrubs and trees grown in the greenhouse.

Leaves simple or compound, entire or toothed, thick; fls. in dense heads which are arranged in racemes or panicles; calyx with minute or obsolete limb; petals 4–7, usually 5, the stamens of the same number and with ovate or oblong anthers; ovary 3–7-loculed, the styles rather long and bearing a flat, not thick, stigma: fr. globose and berrylike.—Some ninety species-names have been referred to this genus, but the number of species is probably much less than this number. In the trade, the species of *Oreopanax* are usually known as aralias, but in the *Aralia* tribe the petals are imbricate in the bud, whereas in *Oreopanax* they are valvate. Few species of *Oreopanax* are known in cult. Harms (Engler & Prantl, *Pflanzenfamilien*) divides the species into 3 groups,—lvs. digitate, lvs. lobed, lvs. not lobed. The species described below are those which are now most often mentioned in gardening literature, but only the first seems to be much known here.

Propagation is by cuttings and seeds, any time during January, February and March, the earlier the better. Half-ripened growth of the extreme tops should be placed in a warm propagating-bed with a bottom heat of about 80°. Keep them covered with glass and give sufficient moisture and plenty of shade. When the roots are about $\frac{1}{2}$ inch long, they may be lifted carefully and potted off into 2- or $2\frac{1}{2}$ -inch pots, using a mixture of loam, leaf-mold and peat in equal parts,

adding enough sand to make it friable. Keep them shaded close and moist until well established, when they may be brought out into full sun. Increase their pot room until they are in 6- or 7-inch pots. They can be kept in fair condition for some time if fed with liquid manure once or twice a week during the spring and summer. During the summer, they will need syringing on all bright days. Always give enough ventilation to keep the growth from becoming too soft, or the atmosphere from becoming too humid. They thrive in an intermediate temperature, in winter from 55° to 60° with a 15° rise during bright days; in spring and summer 60° to 68° for night, with 75° to 80° with sun. They will require some shade when the sun becomes powerful, but not so much as to make them soft. A good compost to use for bigger shifts would be fibrous soil four parts, leaf-mold and well-decayed cow-manure one part each. Give them plenty of good drainage in order to keep the mixture from becoming sour. Do not let them become dry at the roots. In the winter they will need less water and syringing. Keep thrips down by syringing and fumigations.—*Oreopanax* can also be increased from seed. This seed can be secured through some of the European firms in the spring. It may be sown in pans, using a mixture of loam, peat and sand in equal parts. Cover the seeds about three times their size with finely sifted compost. Place a glass over each pan and keep shaded and moist. They will come better if placed over bottom heat. When large enough to handle, pot off into small pots, using a little heavier mixture than the seed was sown in. They may be shifted and grown on under the above cultural directions. (J. J. M. Farrell.)

A. *Lvs. all simple.*

reticulatum, Decne. & Planch. (*Arália reticulata*, Willd.). Fig. 2676. Small tree, with alternate, thick, entire, oblanceolate lvs. 12–18 in. long, somewhat revolute on the margin, strongly alternate-veined and reticulated with shades of green: fl.-heads spherical, nearly or quite an inch diam. S. Amer.? —A handsome plant for foliage.

AA. *Some of the lvs. strongly digitately lobed or angled.*

Sanderianum, Hemsl. Shrub or small tree, with habit of *Fatsia papyrifera*: lvs. glabrous, thick and glossy, long-stalked, triangular-ovate in outline, on young shoots deeply 3-lobed but on flowering plants cordate and entire: fls. minute, in small, globose heads, which are arranged in racemose panicles. Guatemala. G.C. III. 13:451. A.F. 8:1283.

AAA. *Same or all of the lvs. digitate.*

Epremesnilianum, André. Shrub of striking habit: lvs. large, long-stalked, digitate, the lfts. 7–9, oblong or lanceolate and usually tapering at either end, the middle ones deep-lobed: fl.-heads in a spike. Origin unknown; perhaps a garden form of *O. dactylifolium*, Hort., in which each of the 7 lobes is usually lobed. R.H. 1884, pp. 320, 321. Gn. 29, pp. 354, 355; 30, p. 447.—Named for Count Epremesnil, Dieppe, France. Well-grown plants resemble *Fatsia japonica* (*Aralia Sieboldii*).



2676. *Oreopanax reticulatum*. Properly *Meryta Denhamii*. (× $\frac{1}{2}$)

Andreanum, Marchal. Shrub, with variable foliage: lvs. elliptic to roundish, stalked, the lower surface and petioles red-tomentose, varying from angled to deeply digitate and the divisions pinnatifid; fl.-heads globular, in a terminal raceme. Ecuador. R.H. 1882, pp. 524, 525.

Thibaudii, Hook. Small tree, stellate-pubescent on the young parts: lvs. long-stalked, 5-7-foliate, the lfts. lanceolate or oblanceolate, entire, 6 in. or less long, dark green; fl.-heads $\frac{1}{3}$ in. diam., in a terminal raceme 1 ft. long. Mex. B.M. 6340.

O. pedunculatum was once listed in Calif., with following description: "lvs. palmate, tinged with red; makes a fine foliage plant. Guatemala." It turns out to be *Koeberuteria paniculata*.—*O. trilobum*, Hort., a plant offered abroad, may belong here.

L. H. B.

ORIGANUM (ancient Greek name said to mean *delight of mountains*). *Labiatae*. MARJORAM. Sweet herbs; and a few species grown in rock-gardens and borders for the ornamental foliage and flowers.

Perennial herbs or undershrubs, with fls. in 2-fl. whorls, rarely 6-10-fl., crowded into globose or oblong spikelets which are disposed in terminal corymbs or panicles; bracts colored and larger than the calyx, or green and smaller; calyx various, 5-toothed or 2-lipped; corolla 2-lipped, the upper or posterior lip 2-lobed or emarginate, the lower 3-lobed; stamens 4, included or exserted; style 2-lobed: nutlets ovoid or oblong, smooth.—About 30 species, largely in the Medit. region, but also in extra-Trop. Asia. Botanically these plants are closely allied to the thyme, but the fls. of marjoram are borne in bracted heads, while those of thyme are borne in few-fl. whorls which are axillary or spicate above. By some authors, the genus is divided into *Origanum*, with 5-toothed and more or less 13-nerved calyx, and *Majorana* with oblique calyx-mouth, the upper lip entire and the lower one small or wanting.

The sweet marjoram is *O. Majorana* (or *Majorana hortensis*), not uncommon in gardens. The pot marjoram appears to be very little known in this country. It is commonly referred to *O. vulgare*, although sometimes to *O. Onites*. The former is probably the species concerned, although it is not impossible that both species are confused in this horticultural name, pot marjoram.

Cultivation.—Sweet or annual marjoram (*Origanum Majorana*) is a native of the countries bordering the Mediterranean sea. It is an erect branching perennial, bearing grayish green rounded or oval leaves, small whitish flowers in terminal clusters which appear in midsummer, and little oval dark brown seeds. The plant has a pleasing odor and warm aromatic bitterish taste, due to a volatile oil which is soluble in water, is officinally credited with tonic and gently excitant properties, and, as an infusion, is employed in domestic medicine to "bring out the rash" in such diseases as measles. More frequently than in medicine, however, its green parts are used as a condiment, being highly esteemed as a seasoning for soups, stews, meat-pies and dressings. In the garden this plant is treated as an annual, hence the name "annual marjoram." This practice became necessary since the plants are prone to winter-kill unless carefully protected. Its propagation is also somewhat precarious, owing to the small size of the seeds and the tenderness of the seedlings when exposed to the sun. Shade, therefore, until the plants are well rooted is usually necessary. Successional plantings may be made throughout the spring; sometimes transplanting from hotbeds or coldframes in May or June is practised. The plants should stand 6 inches asunder in rows 12 inches apart, in light and dry but good soil, be kept clear throughout the season, and harvested for winter use just before flowering, the plant being cut close to the ground and hung in a cool, airy place to dry. If planted early, leaves may be gathered in late spring. According to Dreer, American-

grown seed is better than imported seed for winter use, as it makes more bulk, while imported seed is better when the plants are to be cut green for summer use.—Pot marjoram (*Origanum vulgare*), a branching hardy perennial, about 2 feet tall, bearing in midsummer pink or purple flowers, and small brown oval seeds, grows wild on the borders of European woods. The highly aromatic leaves and the young shoots gathered just before blossoming are used like those of sweet marjoram. The plant is of easy culture, succeeding in all warm garden soils. It may be propagated by seed, but, where established, division in spring or early autumn is generally practised. The plants should be set 10 inches asunder in rows 15 inches apart, and kept well cultivated. Dwarf pot marjoram, a variety that comes true from seed, bears large heads of whitish flowers, and is often used as an edging plant. (M. G. Kains.)

A. *Spikelets erect.*

B. *Calyx of 5 nearly or quite equal teeth: fl.-bracts medium in size, often colored.*

vulgare, Linn. Rootstocks nearly horizontal: plant more or less hairy: lvs. stalked, broadly ovate, subserrate or entire, broadly rounded at the base or subcordate; fls. purplish (varying to pink or nearly white), in corymbed clusters or short spikes; bracts purplish, about the length of the calyx; corolla longer than calyx; 2 or 4 of the stamens exserted.—Cult. in old gardens; also wild along eastern roadsides and in fields, naturalized from Eu. An erect herb, 1-2½ ft. high, aromatic. It runs into several forms, one of them being var. *aureum*, Hort., with golden or yellow foliage.

BB. *Calyx oblique or 2-lipped: fl.-bracts medium or small, not prominently colored.*

c. *Lvs. stalked.*

Majorana, Linn. (*Majorana hortensis*, Moench). SWEET MARJORAM. ANNUAL MARJORAM, from the method of cult., although the plant is perennial. Nearly glabrous, 1-2 ft.: lvs. oblong-ovate, entire, obtuse, tomentose; fls. purplish or whitish; spikelets oblong, 3-5 in a cluster. Eu.

CC. *Lvs. not stalked.*

Onites, Linn. (*Onites tomentosa*, Raf. *Majorana Onites*, Benth.). Perennial: st. erect, nearly simple, hirsute: lvs. sessile, ovate, subserrate, villous or tomentose, mostly cordate at the base; fls. as in *O. Majorana* but a little larger; spikelets ovoid, very numerous in a dense cluster. S. E. Eu., Asia Minor, Syria.

AA. *Spikelets nodding: fl.-bracts large, often colored, usually concealing the calyx.*

sipylæum, Linn. (*O. hybridum*, Mill.). Woody and procumbent at base, the upright branches very villous: lvs. short-petioled, entire, the lower ones suborbicular and hairy, the upper ones ovate, glabrous and glaucous; floral lvs. small: spikes oblong, solitary or in 3's, nodding, the bracts ovate and colored; calyx glabrous, the 3 upper teeth longer; corolla pink. Levant; named for Mt. Sipylus.—A useful little plant for rock-work and dry places; 8-16 in. high; fl.-heads rose-color.

pulchellum, Boiss. Perennial, grayish pilose, the sts. ascending: lvs. ovate, obtuse, entire, the lower ones short-petioled and the others sessile: spikes nodding, ovate or oblong, the bracts reddish, ovate, glabrous or ciliate; fls. rose-colored; calyx glabrous, the throat bearded, upper lip repand-tridentate, the lower very short and 2-lobed; corolla-tube not gibbous, twice exceeding calyx. S. E. Eu. and eastward.—Said to be a pretty shrub-like little plant with fl.-heads resembling small hops.

O. Dietamnus, Linn., from Crete (Crete Dittany), is a tender species with entire woolly mottled lvs. and purplish or pink fls. in hop-like heads.

L. H. B.

ORIXA (Japanese name). *Rutaceæ*. Deciduous shrub, with alternate petioled almost entire lvs., and greenish inconspicuous dioecious fls. with 4 sepals and 4 minute petals, the staminate fls. in racemes, the pistillate fls. solitary: fr.

consisting of 4 deliscent pods, each containing 1 black subglobose seed. It has proved hardy in Mass., but has no decorative merit except its bright green foliage, which is not attacked by insects or fungi, and has a strong disagreeable odor like that of ptelea. Orixia seems to grow in almost any soil. Prop. by greenwood cuttings; also by layers and root-cuttings and by seeds. The only species is *O. japonica*, Thunb. (*Celastrus Orixia*, Sieb. & Zucc. *Ilex Orixia*, Spreng. *Othèra Orixia*, Lam.). Fig. 2677. Shrub, to 8 ft., with spreading branches pubescent when young; lvs. obovate to oblong, obtusely pointed, entire or finely crenulate, bright green above, finely pubescent beneath, translucently glandular-punctate, 2-4 in. long: fls. small, greenish: pods about $\frac{1}{2}$ in. long, light greenish brown. April,



2677. *Orixia japonica*. ($\times \frac{3}{4}$)

May. Japan. Gt. 35:1232. I.T. 3:101.

ALFRED REHDER.

ORMOSIA (from Greek, for *necklace*, the brilliant seeds of some species used as beads). *Leguminosæ*. **NECKLACE TREE**. Trees, around the world in the tropics, of 40 or more species, bearing large panicles or racemes of white, lilac or black-purple papilionaceous fls., and often handsomely colored seeds, planted sometimes in warm countries: calyx more or less 2-lobed, the 2 upper teeth being somewhat connate; standard very broad, the wings obovate-oblong and oblique; stamens free and unequal; stigma lateral: pod leathery, woody, or fleshy, oblong to linear and compressed, wingless and 2-valved, sometimes septate: lvs. odd-pinnate, with coriaceous lfts.

monosperma, Urban (*Sóphora monosperma*, Swartz. *Ormòsia dasydrpa*, Jacks.). Fig. 2678. Offered abroad: large tree: lfts. 5 pairs, oblong and pointed, 3-4 in. long: fls. blue, $\frac{3}{4}$ in. long in large rusty panicles: pod $1\frac{1}{2}$ in. long, tomentose, 1-seeded; seed somewhat compressed, irregular in shape, $\frac{1}{2}$ in. or more longest way, bright scarlet with large angular black patch. W. Indies.

Other species do not appear in accessible lists, but they may be sparingly in cult. *O. coccinea*, Jacks., of S. Amer., is in horticultural literature: lfts. ovate, the margins revolute: fls. blue; pod glabrous and shining; seeds scarlet, with black spot.

L. II. B.

ORNAMENTAL GARDENING, or ornamental horticulture, is that branch of horticulture concerned with cultivating plants of all kinds for show and to satisfy the eye rather than for food. It includes floriculture and also the culture of trees for shade and display. (The culture of trees on a large scale for timber and for other profitable purposes aside from ornament is forestry. The culture of trees in general is arboriculture.) Ornamental gardening includes carpet-beding and formal gardening in general, while landscape

gardening is concerned with making nature-like pictures, or at least with the general plan and setting of the place; it also comprises all that part of floriculture that aims to make grounds and gardens beautiful.

ORNITHIDIUM (the diminutive for *bird*, from the form of the flower). *Orchidaceæ*. Epiphytic orchids for the warm greenhouse.

Stems leafy, covered with distichously imbricated sheaths, the 1-lvd. pseudobulbs lateral: fls. medium or small, solitary on peduncles which are fasciated in the axils; sepals and petals similar, the sepals free, a little larger than petals; lip 3-lobed, the lateral lobes erect, sometimes inclosing the column; column usually short and footless; pollinia 4, waxy.—About 20 species, in Trop. Amer.

dénsum, Reichb. f. (*Maxillaria dénsa*, Lindl.). Pseudobulbs oblong, compressed; peduncles densely fasciated; sepals and petals yellowish, the column and lip marked with rose. Mex. B.R. 1804.

frágans, Rolfe. Pseudobulbs ovoid-oblong: fls. few, fragrant, white, faintly flushed with mauve; sepals spreading, oblong-linear, rather acute, the petals somewhat connivent, lanceolate-linear, acute; lip 3-lobed, dull mauve, the lateral lobes small, the middle lobe reflexed, quadrate-oblong, truncate or emarginate.

O. bicolor, Rolfe. Pseudobulbs ovoid, tufted: fls. bright yellow, with a crimson blotch on the front lobe of lip. Colombia.

GEORGE V. NASH.

ORNITHOCÉPHALUS (Greek, *bird* and *head* in allusion to the aspect of the column). *Orchidaceæ*. Epiphytic orchids, the most striking feature of which is the long slender rostellum.

Cespitose herbs with fleshy lvs.: sepals and petals free, spreading; upper sepal concave; labellum subsessile, 3-lobed, lateral lobes broad and thickened, middle lobe elongated; column short with the rostellum conspicuously elongated; pollinia 4.—About 20 species from Brazil to W. Indies and Mex. The geographical range of the species herein described indicates an intermediate temperature. They may be treated like cattleyas.

grandiflorus, Lindl. A dwarf compact epiphyte: lvs. distichous, oblong, obtuse, about $\frac{3}{4}$ in. long: scape from the axil of the lvs.; fls. small, whitish, about $\frac{1}{2}$ in. across, borne in racemes; sepals and petals similar, blotched at base with emerald-green; labellum 3-lobed, somewhat rounded, saccate, keeled beneath. Brazil.

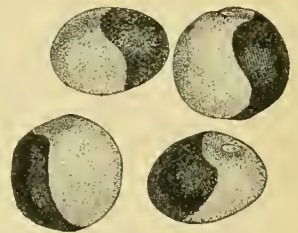
multiflorus, Rolfe. Plant densely cespitose: sts. $2\frac{2}{5}$ in. high, diphyllous: lvs. lanceolate or oblong, somewhat fleshy, about $\frac{1}{2}$ in. long: raceme slender, flexuose, $3\frac{1}{2}$ in. long; fls. numerous, white; sepals reflexed, ovate, concave; petals spreading; labellum pandurate, obtuse, concave above the middle, $1\frac{1}{2}$ in. long, with a suborbicular callus. Brazil.

OAKES AMES.

ORNITHOCHILUS (Greek, *bird* and *labellum*). *Orchidaceæ*. Epiphytic herbs with leafy sts., similar to *Aërides*: sepals subequal, spreading, oblong; labellum spurred; infl. longer than the lvs.; fls. yellow with bands of brown; pollinia 2.—A few species from India.

O. fuscus, Wall. Lvs. subacute, narrowed to the sessile sheathing base, about 6 in. long, about 2 in. wide; infl. longer than the lvs.; fls. small, numerous, in racemes, greenish yellow, with bands of brown and with the pectinate lateral lobes of the labellum purple below; sepals and petals oblong.

OAKES AMES.



2678. Seeds of *Ormosia monosperma*. ($\times 1$)

ORNITHOGALUM (Greek, *bird and milk*; application not obvious). *Liliaceae*. This genus includes the star of Bethlehem, a dwarf hardy bulbous plant that bears umbels of green-and-white flowers in May and June; also many other outdoor and indoor bulbs.

Bulb coated, giving rise to linear or very narrow lvs. and a simple leafless scape; fls. white, yellowish or reddish, mostly racemose; perianth persistent; tube none; segms. 6, usually spreading; stamens 6, the filaments more or less flattened and in many species unequal, alternate ones being broader at the base;



2679. *Ornithogalum arabicum*. ($\times 1\frac{1}{2}$)

ovary sessile, 3-celled; ovules many in a cell, superposed; style short or long; caps. membranous, loculicidally 3-valved; seeds globose, usually not crowded nor compressed; often the perianth-segms. are keeled and the green color follows the keel.—Probably more than 100 species, widely spread mostly in the eastern hemisphere. They are particularly numerous in S. Afr. Blue and mauve-purple does not occur in the fls. of this genus, according to Baker.

Horticulturally, ornithogalums may be divided into hardy and tender groups, and each of these may be subdivided into dwarf and tall. The hardy kinds are considered by English amateurs amongst the choicest summer-blooming bulbs for wild gardening. With the remarkable increase of wild gardens in America, the popularity of these bulbs is likely to increase with us. The common star of Bethlehem, *O. umbellatum*, a dwarf kind, is the only ornithogalum that is common in American gardens. *O. nutans* has escaped from a few premises; in England "it is a very popular species and one of the most easily managed of all the ornithogalums. In borders amongst other named bulbs, however, it becomes a great nuisance, on account of the freedom with which its innumerable bulbils are formed. In a semi-wild or uncultivated spot it is a capital subject for groundwork; it requires no attention whatever, and flowers freely all through April and May." Of the taller hardy kinds *O. latifolium* and *O. pyramidale* seem to be the most desirable. These may be placed among shrubbery and left undisturbed. A particularly robust clump of *O. latifolium* is recorded as bearing over one hundred spikes of flowers on stalks 3 feet high. *O. pyramidale* sometimes makes a perfect pyramid of

starry white flowers, the spike 12 to 18 inches long, the flowers an inch across, and a hundred or more flowers in a spike.

The tender kinds in cultivation are chiefly from the Cape of Good Hope, although *O. arabicum* is found in the Mediterranean region. When well grown, the latter is probably the showiest of the genus. The white of the large broad-petaled flowers is set off by a gleaming black pistil, which makes a striking feature. *O. arabicum* is suitable for pot culture in northern conservatories, but perhaps the best way to grow it is in quantity in a frame. The bulbs have a way of remaining dormant for a season or two, a difficulty possibly to be associated with insufficient ripening. It is suspected that there are two varieties, a shy-blooming and a free-blooming kind. This may explain some of its reputation for capriciousness. *O. thyrsoides* is easier to grow and earlier to bloom. With gentle forcing it may be had for Christmas in a moderately warm house. *O. revolutum* is very distinct in having revolute instead of spreading segments. *O. caudatum* is cultivated in dwelling houses under the erroneous name of sea onion. The sea onion is *Urginea maritima*, a plant of the same general appearance but distinguishable in leaf, flower and fruit as follows: *Urginea maritima* has leaves 2 to 3 inches wide; raceme $1\frac{1}{2}$ to 2 feet long; bracts 3 to 4 lines long; flowers white with a brown keel; seeds crowded, disk-like. *Ornithogalum caudatum* has leaves 1 to $1\frac{1}{2}$ inches wide; raceme $\frac{1}{2}$ to 1 foot long; bracts 6 to 9 lines long; flowers keeled with green; seeds not crowded nor compressed. The ornithogalums are increased naturally by the new bulbs. In general, they are plants of easy culture.

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exscapum, 8.	narbonense, 10.	thyrsoides, 3.
flavescens, 3.	nutans, 9.	umbellatum, 7.

A. Segms. of perianth self-colored on front and back, not keeled with color (No. 2 tinged outside).

B. Pistil prominent, shining, greenish black.

1. *arabicum*, Linn. Fig. 2679. Bulb ovoid, 1- $1\frac{1}{2}$ in. thick, proliferous: lvs. 5-8, glaucous green, 1- $1\frac{1}{2}$ ft. long, $\frac{3}{4}$ -1 in. wide; scape 1-2 ft. long; raceme 6-12-fld., roundish or deltoid in outline, 3-5 in. long and wide; fls. self-colored, odorless; filaments lanceolate, not cuspidate, alternate ones distinctly broader, but not quadrangular on the base. Medit. region. B.M. 728; 3179 and B.R. 906 (as *O. corymbosum*). G.C. II. 19:665. Gn. 22, p. 249; 32, p. 145; 41, p. 377; 49:308 and p. 309. J.H. III. 61:539. Gn.W. 20:592. G. 10:318; 27:249. C.L.A. 5:48.—The blackish pistil is a beautiful and interesting character. The most popular species for pot culture.

2. *Saundersiæ*, Baker. Bulb large and globose: lvs. many, flaccid, lorate, more than 1 ft. long; peduncle terete, 2-3 ft., bearing many corymbose fls. on pedicels to 2 in. long with greenish lanceolate bracts; perianth white, $\frac{1}{2}$ in. long, the segms. orbicular, tinged outside with green; stamens half as long as perianth; ovary blackish green, with a very short style. S. Afr.

BB. Pistil not a striking feature, dull, smaller.

c. Number of fls. in a cluster less than 50.

3. *thyrsoides*, Jacq. Bulb globose, $1\frac{1}{2}$ -2 in. thick: lvs. 5-6, lanceolate, 6-12 in. long, 1-2 in. wide, attenuate above, the margin obscurely ciliate; scape $\frac{1}{2}$ - $1\frac{1}{2}$ ft. high; raceme 12-30-fld., dense, triangular in outline, 3-4 in. wide; fls. self-colored; segms. ovate and strongly imbricate; filaments alternately longer and lanceolate, alternately shorter, dilated above the base and bicuspidate. S. Afr. B.M. 1164 (fls. white, with a brown eye).—In cult., the perianth may be 1 in. long. Var.

aureum, Ait. (*O. aureum*, Curt.), has golden yellow fls. B.M. 190. Var. *flavescens*, Ker, has pale yellow fls. B.R. 305.—**O. kewense**, Hort., is a hybrid of *O. thyrsoïdes* and the var. *aureum*: like *O. thyrsoïdes*, but color is bright buff-yellow.

4. **lacteum**, Jacq. Bulb whitish, subglobose, to $1\frac{1}{2}$ in. diam.: lvs. 9 or 10, somewhat fleshy, rosulate about base of st., lorate, 12 in. or less long, the margins lightly ciliate: peduncle strong and erect, 1–2 ft., bearing a dense 20–50-fl. raceme that becomes 6 in. long and about 2 in. wide, the pedicels erect-spreading and the lowermost as much as 1 in. long; perianth $\frac{1}{2}$ – $\frac{3}{4}$ in. long, scentless; segms. oblong, about $\frac{1}{3}$ in. wide, milk-white. S. Afr. R.B. 34:307. G.C. III. 57:193.—An interesting and variable species.

cc. Number of fls. in a cluster of 50 or more.

5. **latifolium**, Linn. Bulb globose, $1\frac{1}{2}$ –2 in. diam.: lvs. 5–6, ascending, glabrous, fleshy herbaceous, broadly lorate, 12–15 in. long, $1\frac{1}{2}$ –2 in. wide in cult.: scape or peduncle strong and erect, 1–2 ft., bearing a raceme 12–18 in. long and containing 50–100 or more fls.; perianth about $\frac{1}{2}$ in. long, the segms. milk-white and oblong-oblancoate; filaments about equal, lanceolate. Tauria, Caucasus, Kurdistan, Arabia, Egypt. B.M. 876. B.R. 1978.

AA. Segms. of perianth with a green outer face, the outer segms. narrowly margined white.

B. Cluster inversely pyramidal in outline.

6. **tenuifolium**, Guss. Bulb ovoid, 1 in. thick, simple: lvs. 5–6, narrowly linear, 5–6 in. long, 1–2 lines wide, unspotted: scape 2–3 in. long; raceme 6–10-fl., corymbose or inversely triangular in outline, 2–3 in. long and wide; pedicels ascending; fls. with outer perianth-segms. margined white. Medit. region.

BB. Clusters quadrangular in outline.

c. Number of fls. 12–20.

7. **umbellatum**, Linn. STAR OF BETHLEHEM. Bulb subglobose, 1 in. thick, bearing numerous bulbils: lvs. 6–9, narrowly linear, 6–12 in. long, 2–4 lines wide, deeply channeled, distinctly spotted white; scape 4–6 in. long; raceme 12–20-fl., quadrangular in outline, 4–6 in. long, 6–9 in. wide; lower pedicels in fr. spreading; fls. white, with outer perianth-segms. margined white. Medit. region. Escaped from old gardens in U. S. G. 5:72; 27:248.

cc. Number of fls. 3–12.

8. **exscapum**, Ten. Bulb, ovoid, $\frac{3}{4}$ –1 in. thick, not proliferous: lvs. 5–6, narrowly linear, 4–6 in. long, 1–2 lines wide, glabrous, spotted, disappearing after the fls.: scape 1– $1\frac{1}{2}$ in. long; raceme 3–12-fl., quadrangular in outline, $1\frac{1}{2}$ in. long, $2\frac{1}{2}$ –3 in. wide; lowest pedicels in fr. flexed; bracts $\frac{3}{4}$ –1 in. long, shorter than the pedicels; fls. with outer perianth-segms. margined white; style very short. S. Eu.

AAA. Segms. of perianth more or less white-faced but keeled with green on the back.

B. Blossoms nodding.

9. **nütans**, Linn. Bulb ovoid, $1-1\frac{1}{2}$ in. thick, producing offsets freely: lvs. pale green, $1-1\frac{1}{2}$ ft. long, 3–6 lines wide, disappearing after the fls.: scape 8–12 in. long; raceme 3–12-fl., oblong-cylindrical in outline; pedicels shorter than the bracts; fls. white on upper side, green on the back, margined white, the lower ones nodding. Eu., Asia Minor. B.M. 269. Gn. 32:418 and p. 77; 41, p. 376. Gn.W. 21:871.—Sometimes escaped in U. S.

BB. Blossoms erect or ascending.

c. Width of lvs. 3–6 lines.

10. **narbonense**, Linn. Bulb ovoid, 9–15 lines thick: lvs. strap-shaped, $1-1\frac{1}{2}$ ft. long, 3–6 lines wide, gla-

brous, glaucous green, scarcely disappearing before the end of flowering: scape $1-1\frac{1}{2}$ ft. long; raceme 20–50-fl., oblong-cylindrical, 4–8 in. long, $1\frac{1}{2}$ –2 in. wide; lowest pedicels 9–15 lines long; fls. whitish, keeled green on the back; filaments lanceolate at base, not squared. S. Eu. B.M. 2510 (striped green back and front). Var. **pyramidale**, Hort. (*O. pyramidale*, Linn.), is considered by Baker to be a robust, large-fl. garden form, but it is said to grow wild in Spain and Portugal and may be a distinct species. Fls. white, with a green stripe on back. Gn. 41:376; 73, p. 603.

11. **biflorum**, Don. Bulb globose, $\frac{3}{4}$ – $1\frac{1}{4}$ in. diam.: lvs. 4–6, somewhat fleshy, linear, attenuate above, concave, 6–12 in. long and 3–6 lines wide; peduncle or scape 6–12 in. high, with a lax 6–20-fl. raceme that is 3–4 in. long, the pedicels strict and erect-spreading, the lowermost in 2's; perianth about $\frac{1}{2}$ in. long; segms. ovate-lanceolate and subacute, the back with a narrow green stripe; style short (1 line long). Chile, Peru. G. 26:129.—Said to be a good species for greenhouse decoration.

cc. Width of lvs. 9–18 lines.

12. **longibracteatum**, Jacq. Bulb ovoid, 3–4 in. thick: lvs. 5–6, rather fleshy, glabrous, lanceolate, $1\frac{1}{2}$ –2 ft. long, $\frac{3}{4}$ – $1\frac{1}{2}$ in. wide, persistent until after flowering: scape $1\frac{1}{2}$ –2 ft. long; raceme dense, 30–60-fl., oblong-cylindrical, 6–9 in. long, 15–18 lines wide; lowest pedicels 9–12 lines long; fls. whitish, keeled green on the back; bracts 9–15 lines long; filaments alternately linear and lanceolate at the base. S. Afr.

13. **caudatum**, Ait. Bulb ovoid, 3–4 in. thick: lvs. 5–6, fleshy-herbaceous, lorate, $1\frac{1}{2}$ –2 ft. long; $1-1\frac{1}{2}$ in. wide: scape $1\frac{1}{2}$ –3 ft. long; raceme dense, $\frac{1}{2}$ –1 ft. long; perianth $\frac{1}{2}$ in. long, white; banded green on face, and keeled green; stamens three-fourths the length of perianth; bracts 6–9 lines long; filaments alternately lanceolate and quadrate at the base. S. Afr. B.M. 805.—Window plant.

AAAA. Segms. of perianth white, with a brown or greenish yellow eye, revolute.

14. **revolutum**, Jacq. Bulb globose, 1 in. or less diam. lvs. 5–6, lanceolate, 6–9 in. long, 6–9 lines wide; peduncle or scape terete and stiff, 1 ft. high, bearing a dense subcorymbose raceme; fls. not keeled with green, white with yellowish eye; segms. oblong and obtuse, $\frac{1}{4}$ in. broad, reflexing or turning back from near the base; style very short and stout. S. Afr. B.M. 653. B.R. 315.

WILHELM MILLER.

L. H. B.†

ORNITHOPUS (*bird's foot*, referring to form of pod). *Leguminosæ*. A few plants allied to Coronilla and Scorpiurus, from the Canary Is. through Eu. to W. Asia; and also in Trop. Afr. and S. Brazil. They are little known horticulturally. The fls. are very small, whitish, rose or yellow in umbels, papilionaceous; standard nearly orbicular; wings oblong; keel obtuse and nearly straight; stamens diadelphous: pod much exceeding the calyx, separating into 1-seeded joints or parts. They are slender spreading annuals with pinnate lvs. and axillary peduncles.

The genus is known in cult. in the serradella, a forage plant in Eu., but of very small importance in this country. It is *O. sativus*, Brot., of Spain and Morocco: slender-stemmed and much-branched annual, $1\frac{1}{2}$ –2 ft., with strong tap-root: lfts. many, ovate: fls. rose-colored, in few-fl. umbels. It is sown in early spring, 40–60 lbs. of seed to the acre.

L. H. B.

OROBANCHE (old Greek; said to be given because the species strangle or kill the orobus or vetch). *Orobanchææ*. BROOM-RAPE. Parasitic herbs of purple or brown color, without green foliage, growing on the ground and attached to the roots of other plants. Other genera of the family are Aphyllon and Lathræa, which

see. In Orobanche, the calyx is deeply divided into 2 or 4 pointed sepals; corolla broadly tubular or bell-shaped, often curved, more or less 2-lipped; stamens 4, in 2 pairs; ovary 1-celled.—About 100 species, if Aphyllon and some others are included, widely distributed, a number of them in Eu. They are scarcely horticultural subjects, although it is possible to grow them. Writing in *The Garden* (59, p. 93), Francis D. Horner, says that he was able to grow *O. speciosa* 3 ft. 8 in. high, with many showy fls., and that it began to bloom at 8 in. high. He establishes them on the roots of beans. He grows 3 or 4 beans in a 7-in. pot, and when they are 2 or 3 lvs. high and the roots well around the pot, orobanche seeds are sown over the damp surface. Before the beans are pot-bound, they are planted out with the ball of earth unbroken. The orobanche heads will appear in July. It is essential that the beans do not get into bloom before the seed of the parasite is sown, otherwise it will not get a sufficiently early start to ripen. When fls. of the parasite have turned into shades of brown and the stems have fallen, the plants are stored for seed, which is minute.

L. H. B.

ÓROBUS (an old Greek name). *Leguminosæ*. A genus not now kept separate, and referred mostly to *Lathyrus*, from which it was distinguished largely by its erect habit and lack of tendrils; some of the species now go to *Vicia*. Five species-names were found by Beal (Study of Genus *Lathyrus*, Cornell Bulletins) to be offered by American seedsmen: *O. niger* (= *Lathyrus niger*), *O. vernus* (= *Lathyrus vernus*), *O. lathyroides* (probably = *Vicia oroboides*), and *O. albus* and *O. superbus* which are probably horticultural forms of *Lathyrus vernus*. Abroad there are also listed *O. aurantiacus*, which may be *Vicia aurantia*; *O. canescens*, *O. azureus*, *O. varius*, *O. Smithii* with "creamy yellow fls., dwarf grower," which probably belong in *Lathyrus*.

ORÓNTIUM (one of many names arbitrarily applied by Linnæus; he probably had in mind some water plant growing in the Syrian river Orontes). *Aracææ*. A hardy native aquatic plant, which bears in early spring yellow "clubs" on white stalks. The "club" is a cylindrical spadix 1 to 2 inches long.

Spathe usually soon deciduous; fls. hermaphrodite, covering the whole spadix; sepals scale-like, imbricated upon the ovary, usually 4 in the upper and 6 in the lower fls.; ovary 1-celled; ovule solitary, semi-anatropous; fr. a green utricle.—One species, found in swamps and pools from Mass. to Fla., mostly near the seacoast, but extending as far inland as Cent. Pa. and La.

aquaticum, Linn. **GOLDEN CLUB**. Lvs. ascending or floating, according to the depth of the water, oblong-elliptic, no distinct midrib, but numerous parallel veins; blade 5–12 x 2–5 in.; stalk 4–20 in. long; scape $\frac{1}{2}$ –2 ft. long. B.B. 1:364. L.B.C. 5:402. R.H. 1888:85. Gn. 27, p. 213. G.M. 54:247.—The foliage is handsome, dark velvety green above, silvery below. The plant is very strong and deeply rooted, growing in water 10–18 in. deep. On account of its firm hold on the soil it may be planted in swifter water than most aquatics. It has the fault of being difficult to eradicate when firmly established.

F. W. BARCLAY.

ORÓXYLUM (Greek, *a mountain tree*; nevertheless it grows anywhere from sea-level to an altitude of 3,000 ft.). Also written *Oroxylon*. *Bignoniaceæ*. An ornamental tree from S. Asia, with large opposite twice- or thrice-pinnate lvs.; fls. in terminal panicles; calyx leathery, campanulate, truncate or shortly toothed; corolla campanulate, white or purplish with 5 crisped and toothed lobes imbricate in bud; stamens 5, slightly exserted; disk large, fleshy; fr. linear, septically deliscent; seeds broadly elliptic, compressed with a broad transparent wing.—A very striking plant with bold much-divided

glossy foliage and ample terminal panicles of large white or purple fls. followed by very long and narrow pendulous caps. It is cult. outdoors in Calif. and in Eu. in greenhouses. Demands rich soil. Prop. by seeds and by cuttings with bottom heat.

indicum, Vent. (*Calosánthes indica*, Blume). Tree, to 10 ft.; lvs. 2–4 ft. across; lfts. ovate, entire, glabrous, about 5 in. long; racemes peduncled, to 10 in. long; fls. 2½ in. long and 2–3½ in. across; caps. 1–3 ft. long and 2–3 in. wide, compressed. India to Cochinchina and Malaya. Wight, Leon. 1337.

O. flavum, Rehd. = *Radermachia pentandra*.

ALFRED REHDER.

ORPINE, or STONE CROP: *Sedum*, particularly *S. Telephium*.

ORRIS-ROOT, or IRIS-ROOT: *Iris florentina* and others.

ORTHOCÁRPUS (Greek, *straight fruit*, which distinguishes this genus from *Melampyrum*). *Scrophulariaceæ*. Annual and perennial herbs, which may be transferred to gardens: lvs. alternate, incised, those in the infl. sometimes colored; fls. mostly white, yellow or cream-colored, sometimes marked, in spikes; corolla tubular, 2-lipped; calyx 4-cleft; stamens 4.—Species about 30, W. N. Amer., and 1 in S. Amer. *O. purpurascens*, Benth., is something like the painted cup (*Castilleja*). It is a Californian annual, growing a foot high, with gaudy bracts, and crimson or purple corolla 1–1¼ in. long, the lower lip white-tipped and with yellow or purple markings. It is a common and showy plant growing in the Sierra Nevada foothills, the interior valleys and Coast ranges. This plant was offered in 1891.

L. H. B.

ORTHÓSIPHON (name refers to the *straight tube*). *Labiataæ*. Annual or perennial herbs sometimes subshrubs, of more than 100 species in the tropics from Afr. to Austral., little known in cult.; lvs. opposite or whorled, glandular-dotted; infl. terminal, sometimes with colored bracts at top, each whorl 2–6-fl., fls. variable in size; calyx unequally 5-toothed; corolla-tube mostly surpassing the calyx; corolla-limb 2-lipped, the upper lip shortly 3–4-lobed and the lower concave or boat-shaped; stamens 4, exserted; ovary deeply 4-lobed, the style filiform and exserted. *O. stamineus*, Benth., is probably the species most likely to be found in glasshouses: 1–2 ft., glabrous or pubescent, the st. 4-angled; lvs. ovate, acuminate, coarsely toothed, petioled; fls. white or purplish, about 1 in. long, the corolla-tube thrice longer than calyx; stamens much exserted. India. B.M. 5833. G.Z. 29:145.

L. H. B.

ORTHROSÁNTHUS (Greek, *morning flower*; because the fls. open in the morning and fade before noon). *Iridaceæ*. Small plants for indoor use, listed with dealers among bulbs, bearing bright flowers on a scape arising from the clump of narrow leaves.

Orthrosanthus is a genus of 9 or 10 species, from Trop. or extra-Trop. Amer. and Austral. Rootstock short; lvs. firm, linear, equitant; clusters many-fl., panicle; fls. pale blue; pedicels so short that the caps. is not protruded from the spathe; perianth-tube very short or none; segms. oblong, nearly equal, spreading; filaments free or connate only at the base; ovary 3-celled; ovules many, superposed; style-branches alternating with the anthers; seeds minute. Very near *Sisyrinchium* which is a more variable genus, and has longer pedicels.

multiflorus, Sweet (*Libertia azurea*, Hort. *Sisyrinchium cyaneum*, Lindl.). Lvs. a dozen or more, 1–1½ ft. long, ½–1½ in. wide; panicle 4–6 in. long; caps. obtuse. S. and W. Austral. L.B.C. 15:1474. B.R. 1090.—*O. multiflorus* is a charming plant something like blue-eyed grass or *sisyrinchium*. It has a tuft of grassy foliage a foot or two high, and sky-blue 6-parted fls. an inch or more across, which open one after

another for a week or so. Horticulturally it is classed among tender bulbs, although it has a short thick rhizome.

WILHELM MILLER.

ORÛZA (derived from the Arabic name, *Eruz*). *Gramineæ*. Marsh plants, with fls. in panicles: spikelets 1-flid., laterally compressed; glumes 2, minute; lemma and palea about equal, keeled, scabrous, the former usually more or less awned.—Six species of the tropics, including *O. sativa*, Linn., the well-known rice of commerce. Dept. Agric., Div. Agrost. 20:49. This



2680. *Oryzopsis racemosa*. ($\times 3/4$)

is a native of the Old World tropics, and is naturalized in Brazil; cult. extensively in China and India and more recently in the coast region of our southern states. Contrary to the usual supposition, rice paper is not made from rice, but from paper mulberry or bamboo.

A. S. HITCHCOCK.

ORYZÓPSIS (Greek, *orusa*, rice, and *opsis*, appearance, from a fancied resemblance to that grain). *Gramineæ*. MOUNTAIN RICE. Mostly tufted perennials, with narrow panicles of rather large greenish one-flowered spikelets.

Glumes thin, nerved, nearly equal; lemma coriaceous, sub-cylindrical, with a short callus at base, and bearing a simple untwisted deciduous awn.—Contains about 24 species of temperate regions. Three of our native species are offered by dealers in wild plants.

racemosa, Ricker (*O. melanocarpa*, Muhl.). Fig. 2680. Distinguished by its leafy culm, the lvs. broad and flat; panicle simple or compound; lemma blackish; awn about 1 in. long. Rocky woods, New England to Mo.—Blooms late in summer.

asperifolia, Michx. This and the next have tufted, naked culms, the flat, concave or involute, rough-edged, evergreen lvs. crowded at the base; culms 9–18 in. high, bearing nearly bladeless sheaths; awn $1/3$ in. long. Northern states to Colo.—Blooms early in spring.

pungens, Hitchcock (*O. canadensis*, Torr.). Culm 6–15 in.: lowest sheaths leaf-bearing; lvs. involute, filiform; awn very short, deciduous or wanting. Maine to Minn., on rocky hills; rare. Dept. Agric., Div. Agrost. 20:63.

miliacea, Benth. & Hook. Perennial, 2–3 ft.: blades flat, $1/3$ in. wide; panicle loose and open, as much as a foot long, with spreading branches; spikelets $1 1/2$ lines long, with a deciduous straight awn 2 lines long. Eu.—A form of this (called also *Milium Thómasii*, Duby, and *Piptathërum Thómasii*, Kunth) with numerous sterile lower branches of the panicle, is sometimes cult. for ornament.

A. S. HITCHCOCK.

OSAGE ORANGE: *Maclura*.

OSBÉCKIA (Peter Osbeck, 1723–1805, student of Linnaeus, Swedish naturalist). *Melastomaceæ*. About 60 species of herbs, subshrubs and shrubs in the tropical parts of the eastern hemisphere, only seldom cult. for the pink or reddish showy fls. that are borne in heads or panicles or sometimes solitary; usually erect, and scabrous or hispid; lvs. 3–7-nerved, somewhat serrate or entire; calyx-tube urn-shaped or nearly globose, hispid, the limb mostly 5-lobed and the lobes sometimes deciduous; petals commonly 5, obovate; stamens 10 as a rule, the anthers with mostly 2 tubercles at base; caps. small, in the dry calyx-tube. They are grown as warmhouse herbs. Perhaps *O. stellata*, Wall. is the species most likely to be found in cult.: shrub, 6–7 ft. or less, with 4-angled branchlets; lvs. opposite, ovate-lanceolate, acuminate, 3–6 in. long, ciliate, 5-nerved; fls. lilac-red, in terminal few-flid. clusters; petals 4, nearly or quite orbicular, ciliate, $1 1/2$ in. long. India, China. B.M. 8500. J.F. 2:168. L. H. B.

OSIERS are willows used for baskets and willow-ware in general. Some dogwoods are also sometimes called osiers. The various kinds are described under *Salix* and *Cornus*. Osier-culture is generally considered as belonging to general agriculture, rather than to horticulture, and is therefore not treated here.

OSMÁNTHUS (Greek, *fragrant flower*). *Oleaceæ*. Ornamental woody plants grown for their handsome foliage and the white fragrant flowers.

Evergreen shrubs or small trees: lvs. usually opposite, short-petioled, entire or serrate; fls. axillary or terminal, in cymes or short panicles, perfect, polygamous or dicecious; calyx short, 4-toothed; corolla short-tubular, with 4 imbricate lobes; stamens 2, rarely 4; ovary 2-celled; fr. an ovoid drupe with a 1-seeded stone.—About 10 species in E. and S. Asia, and Polynesia, and 1 in N. Amer. Sometimes united with *Olea* which differs chiefly in its valvate corolla-lobes.

The osmanthus in cultivation are handsome shrubs with coriaceous rather large leaves and small white very fragrant flowers in axillary clusters followed in the fertile plants by ovoid bluish drupes but rarely produced in cultivation. The hardiest species is *O. Aquifolium* which is hardy in sheltered positions as far north as New York and possibly to Massachusetts. All the others are tenderer and can be grown only in the South and in California. In the North, *O. fragrans* is frequently grown as a greenhouse plant for its very fragrant

flowers. It is of the easiest culture in an intermediate temperature. It is almost a continuous bloomer, although ordinarily it should be rested in late winter or summer in order to ripen the wood for fall and winter bloom. Be careful not to overpot, and keep the plant free from mealy-bug. Out-of-doors all the species prefer a place shaded from the mid-day sun. Propagation is usually by cuttings of half-ripened wood in late summer under glass; seeds are rarely obtainable and do not germinate until the second year; grafting on privet, as is sometimes done, is not to be recommended.

Greenhouse treatment of the Olea fragrans of gardens.—This fragrant plant can be grown in a cool house, one that has a night temperature of 45° to 50° in the winter months. The plants should be grown just as cool as possible in the summer months, and allowed to come into flower in their natural way, as they do not take kindly to any kind of forcing. About the first of June, they may be plunged outside in a partially shaded



2681. *Osmanthus fragrans*. ($\times \frac{1}{2}$)

situation where they can be watered and syringed. By September, they may be placed in a cool and airy house where, by receiving care as to watering and ventilation, they will show bloom late in autumn or early winter. When they are through flowering, they may be repotted, using a compost of fibrous soil four parts, well-decayed cow manure one part, leaf-mold one part, and enough of sand to keep it porous.—They will root from ripened points of the young growth placed in sand in a warm propagating-bed. When rooted, they may be potted off into small pots, and grown on in a temperature of 50° to 55°, giving them shade and moisture until they become well established. Give repeated shifts as they fill the pots until they have reached a 7- or 8-inch pot. They may be kept for some time in good vigor by top-dressings and with liquid manure in these pots. When using the compost for these large pots, let the mixture be as lumpy as possible. Do not overlook the importance of giving them plenty of drainage as they will not tolerate anything like a stagnant compost. If the aphid bothers, give light fumigations for two or three nights. When scale shows itself, give a thorough sponging with some good insecticide. (J. J. M. Farrell.)

A. *Corolla-tube shorter than the lobes or nearly as long; lvs. $1\frac{1}{2}$ –5 in. long.*

B. *Lvs. with small teeth or entire, $2\frac{1}{2}$ –7 in. long.*

fragrans, Lour. (*Olea fragrans*, Thunb.). Fig. 2681. Small tree, to 30 ft., or shrub; lvs. elliptic to oblong-lanceolate, acute or acuminate, cuneate at the base, finely and sharply toothed or entire, reticulate beneath; fls. very fragrant, in clusters on slender pedicels $\frac{1}{2}$ – $\frac{3}{4}$

in. long; corolla divided nearly to the base; drupe ovoid, about $\frac{1}{2}$ in. long. Early spring. Himalayas, China, S. Japan. B.M. 1552. L.B.C. 18:1786. Gt. 28, p. 276. G. 3:582. Gn. 19, p. 261.

americanus, Benth. & Hook. (*Olea americana*, Linn.). DEVIL-WOOD. FLORIDA OLEA. Shrub or small tree, to 40 ft. with whitish bark; lvs. elliptic to lance-oblong, acute, narrowed into the short petiole, entire, lustrous above, $2\frac{1}{2}$ –7 in. long; fls. fragrant, in short panicles, on short pedicels or nearly sessile; corolla-lobes spreading, about as long as the tube; drupes ovoid, nearly 1 in. long. Early spring. N. C. to Fla. and Miss. S.S. 6:279, 280.

BB. *Lvs. with few coarse spiny teeth, rarely entire, 1–2 in. long.*

Aquifolium, Sieb. (*Olea Aquifolium*, Sieb. & Zucc. *Olea ilicifolia*, Hassk.). Shrub or small tree, to 20 ft.: lvs. oval or ovate to elliptic-oblong, with 2–4 strong spiny teeth on each side, rarely entire, lustrous, 1–2 in. long; fls. fragrant, in axillary clusters, on slender pedicels about $\frac{1}{2}$ in. long; corolla divided nearly to the base, with reflexed lobes; sepals entire: fr. ovoid, $\frac{1}{2}$ – $\frac{3}{4}$ in. long. June, July. G.C. II. 7:239 (as *O. ilicifolius*); III. 2:379. S.I.F. 1:82. Var. *myrtifolius*, Nichols. (*O. myrtifolia*, Hort.). Lvs. smaller, entire, acute or acuminate. Gn. 50, p. 86. Var. *rotundifolius*, Nichols. (*O. rotundifolius*, Hort.). Lvs. about 1 in. long, often obovate, entire or with short obtusish teeth; a dwarf slow-growing form. Var. *atropurpureus*, Schneid. (*O. Aquifolium* var. *ilicifolius purpureus*, Nichols.). Foliage purplish black while young, later green with purple tinge. Var. *argenteo-marginatus*, Hort., with white, and var. *aureo-marginatus*, Hort., with yellow variegation.—*O. Aquifolium* has often been confused with *O. Fortunei* (see suppl. list) and the true *O. Aquifolium* distinguished as var. *ilicifolia* or *O. ilicifolia*.

AA. *Corolla-tube much longer than the lobes, $\frac{1}{3}$ – $\frac{1}{2}$ in. long; lvs. $\frac{1}{2}$ –1 in. long.*

Delavayi, Franch. Shrub, to 6 ft.: young branchlets finely pubescent; lvs. ovate or ovate-elliptic, acute or obtusish, cuneate or rounded at the base, sharply or indistinctly toothed; fls. in terminal, 5–8 fld. cymes, fragrant, white; pedicels short; anthers inclosed in the tube: fr. ovoid, bluish black. Early spring. S. W. China. B.M. 8459. R.H. 1912, p. 173. Gn. 75, p. 178. G. 33:225. V.F. 185. G.C. III. 55:269. G.M. 57:336.

O. armatus, Diels. Allied to *O. fragrans*. Shrub; lvs. oblong-lanceolate to lanceolate, remotely spiny-toothed, 3–4 in. long; fls. in axillary clusters, on stout pedicels scarcely $\frac{1}{2}$ in. long. Cent. and W. China.—*O. burifolia*, Hort., is probably *Olea capensis*, Linn., a shrub from S. Afr.—*O. Fortunei*, Carr. (*O. japonicus*, Makino). Probably hybrid of *O. Aquifolium* and *O. fragrans*. Lvs. elliptic-ovate to oblong-ovate, with few spiny teeth or many small teeth, 3–4 in. long; sepals denticulate. R.H. 1864, p. 70. G.C. II. 6:689; 7:239. Gt. 28, p. 277.—*O. latifolia* and *O. ligustrifolia* of the trade are probably phillyreas.

ALFRED REENDER.

OSMARONIA (derivation doubtful). Syn., *Nuttallia*, Rosaceæ, subfamily *Prunææ*. OSOBERRY. Ornamental woody plant grown for its handsome foliage and early-appearing flowers.

Deciduous shrub or small tree: winter-buds stalked, with few imbricate scales; lvs. alternate, short-petioled, entire, with deciduous small stipules; fls. polygamodioecious or dioecious, white, in racemes; calyx campanulate; petals spatulate-oblong; stamens 15, 10 inserted with the petals, 5 below, with very short filaments; carpels 5; styles not exceeding the calyx-tube: fr. consisting of 1–5 oblong drupes with thin flesh and smooth stone.—One or possibly more species in W. N. Amer.

The osoberrys are usually shrubs with upright clustered stems, bright green generally oblong rather large leaves and with rather small white flowers appearing with the leaves in pendulous racemes followed by bluish black oblong drupes. The flowers resemble

somewhat those of *Ribes americanum*. Hardly as far north as Massachusetts in somewhat sheltered positions, but sometimes injured by late frosts, as it leafs and flowers very early. It prefers a humid soil and a partly shaded situation. Propagation is by seeds sown after maturity or stratified, and by suckers.

cerasifórmis, Greene (*Nuttallia cerasifórmis*, Torr. & Gray). Shrub, 6-15 ft., sometimes tree-like: branchlets glabrous: lvs. oblong-lanceolate, acute at both ends, glabrous above, pubescent beneath, 3-4 in. long; racemes short-peduncled, 5-10-flid., glabrous; pedicels with 2 bractlets; fls. about $\frac{1}{2}$ in. across; petals about as long as calyx-tube, the triangular sepals half as long; drupe $\frac{1}{4}$ - $\frac{1}{2}$ in. long, bluish black, bloomy. April, May: fr. in July, Aug. Brit. Col. to Calif. G.C. II. 19:309; III. 19:489; 43:266, 267. Gn. 34, p. 78. L.I. 9.—Greene has described 5 more species of which *O. demissa*, Greene, seems the most distinct and is probably occasionally cult. in Calif. It is a low shrub, 2-4 ft. high, with rigid upright sts.: lvs. smaller, mucronate, glabrous, prominently veined: racemes numerous, denser; sepals ciliolate: drupes more rounded, very bloomy. San Francisco Bay region.

ALFRED REHDER.

OSMORHIZA (Greek; referring to the sweet, aromatic, edible roots). *Umbelliferae*. A small genus of native herbs, 1 to 3 feet high, sometimes called sweet cicely, but the true sweet cicely is *Myrrhis odorata*, a closely allied European plant, the leaves of which have the scent of anise seed and are used in flavoring. Sometimes listed by dealers in native plants.

Perennial, slender, hirsute or glabrous, with thin soft foliage: lvs. ternately compound, the lfts. ovate and toothed: fls. very small, white, in small few-rayed umbels; calyx-teeth obsolete: fr. linear, glabrous or bristly; carpel slightly flattened dorsally or not at all; styles long or short; seed-face from slightly concave to deeply sulcate: root thick, aromatic. By some botanists, the name *Washingtonia* is used for this genus. The plants thrive in moist more or less shady woodsy places.

A. Fr. with prominent caudate attenuation (2-4 lines long) at base, very bristly.

B. Style a line or more long.

longistylis, DC. Stout, glabrous or slightly pubescent. Canada to Va. and west to Dakota. B.B. 2:530. —Roots with a stronger smell and taste of anise than *O. Claytonii*. Brotherton says it is a much prettier plant than the next, with larger umbels.

BB. Style half a line or less long.

Claytonii, Clarke (*O. brevistylis*, DC.). Rather stout, villous-pubescent: lvs. 2-3-ternate: rays stout, 1-2 in. long; style and stylopodium half a line long. Canada to N. C. B.B. 2:530.

nuda, Torr. Rather slender, glabrous, $2\frac{1}{2}$ ft.: lvs. somewhat hispid, biternate, the lower ones 5 in. long; lfts. ovate to elliptic, 3-lobed, serrate: rays of umbel, 4 in. or less long, the involuclers none: fr. rather more than $\frac{1}{2}$ in. long. Calif.

AA. Fr. without caudate attenuation at base.

occidentális, Torr. (*Myrrhis occidentális*, Benth. & Hook.). Rather stout, puberulent or pubescent: lvs. 2-3-ternate; lfts. $1\frac{1}{2}$ -4 in. long; umbel 5-12-rayed; rays 1-5 in. long; stylopodium and style $\frac{1}{2}$ -1 line long. Sierras to Wash., east.

L. H. B.†

OSMÚNDA (from *Osmunder*, a name of a Saxon god). *Osmundaceae*. A small group of larger ferns, with rather coarse foliage, but highly ornamental from their clustered habit. The sporangia are formed in panicles borne on the veins of reduced lvs., provided with a rudimentary transverse ring and opening vertically.

Osmundas are strong-growing ferns of vigorous constitution, and well adapted for general culture in any fertile soil which is not over-dry. They are deep-rooted ferns and, therefore, require considerable depth of soil. All the species do well in full sunlight, but the most satisfactory position for all the species would be a deeply dug thoroughly enriched border lying north of a wall. *O. regalis* reaches perfection only in rich wet swamps in full sunlight or thin shade, where it may attain a height of 8 feet. *O. Claytoniana* prefers rich peaty soil in moist but not wet, open or partially shaded positions. It may attain a height of 6 feet. *O. cinnamomea* is naturally a fern of the swamp, though not in such wet positions as *O. regalis*. It grows most luxuriantly in partial shade. In a wild state it frequently attains a height of 6 feet. (F. W. Barclay.)

A. Lvs. fully bipinnate.

regalis, Linn. ROYAL FERN. Growing in clumps 2-10 ft. high, some of the lvs. bearing panicles at their apices; pinnae 1-2 in. long, rounded at the base and usually blunt.

Well adapted for open, moist places. E. N. Amer. and Japan.—Commonly called royal fern, flowering fern or king-fern. *O. japonica*, Thunb., is a form with the sporophylls forming distinct lvs. and soon withering away; various crested forms appear in cult. *O. gracilis*, offered by some dealers, is probably a S. American form of *O. regalis*. *O. palustris* and varieties belong also with *O. regalis*. This is a diminutive form from Brazil, with slender elegant fronds, abundantly produced from a woody rootstock. S. 3:30, and p. 42. G. 37:423. Var. *Majá*, G.C. III. 40:161, and var. *crispato-congesta*, a dwarf form, are both forms of *O. palustris*.



2682. Cinnamon fern.—*Osmunda cinnamomea*.

AA. Lvs. bipinnatifid only.

cinnamomea, Linn. CINNAMON FERN. Fig. 2682. Growing in clusters 2-6 ft. high or even more, the fertile lvs. appearing earliest, entirely covered with sporangia, at first green, but becoming pale, tall, and slender, cinnamon-colored at maturity of the spores, the sterile lvs. growing about a crown from a large creeping rootstock. N. Amer.—Very handsome for decorative purposes, especially for low grounds. The creeping sts. of this species and of the other two osmundas are always covered with a very dense tangled growth of blackish fibrous roots. These are dug up and shaken free of soil, and are then largely used as the matrix upon which to grow orchids and other epiphytes. (See *Osmundine*.)

Claytoniana, Linn. INTERRUPTED FERN. Lvs. growing in crowns, with the sporangia confined to a few (4-10) of the median pinnae of the lf., and of a dark brown color. Similar to the preceding, but lacking the tuft of wool in the axils of the pinnae which characterizes the cinnamon fern. N. Amer., Japan; said also to grow in India.

R. C. BENEDICT.†

OSMUNDINE. The material now so largely used in this country, and also exported to Europe in quantities for the rooting medium in which to grow epiphytal orchids. Not long ago it was considered necessary to send to England for peat for this purpose, and the word peat used in this connection meant the roots of the bracken, *Pteris aquilina*, when growing in bog-mold. The supply of this became exhausted, owing to the enormous growth of the orchid cultivation, and it was necessary to find a substitute. The first thing tried was the mats of root-fibers of the common *Polypodium vulgare* as found growing on trees in large masses in the moist climate of Ireland. This was composed of a clear light brown fiber with a little humus, and could be torn off the branches in large mats 2 or 3 inches in thickness, and when cut up in suitable pieces made excellent material. However, the supply was soon exhausted and Belgium furnished a quantity which is still being used to some extent. In the meantime the roots of the two species of *Osmunda* so common and so widespread in this country, *O. cinnamomea* and *O. Claytoniana*, have been found to give very excellent results. These two ferns make huge masses of roots above the level of the soil, sometimes several feet square, and when these are grubbed up, or rather off the ground, sawed in slabs with a cross-cut saw, the fern rhizomes taken out, two grades of material are obtained in which any orchid will grow. The fiber at the base is coarse, black, and contains some earthy matter, and is very suitable for the culture of cypripediums, cecylogynes, and other orchids like the lycastes that are more or less terrestrial. For orchids with the characteristic white aerial roots, the brown upper part of the osmundine is most suitable, as it is sponge-like in color and texture, and will not decay or become unsuitable for at least three years. Care must always be taken in potting orchids to make all firm, or too much moisture will be held in suspension by the osmundine for the roots to ramify and do well.

In cattleyas imported from their native habitats, mats of polypodium are often seen which, together with the orchid roots, enable the plants to anchor securely to the trees. The nature of these fern-masses is identical with that of osmundine except that they are living, whereas the osmundine is not. It is well to use the osmundine as soon as possible after being cut up from the original piece. The pieces are best gathered in autumn, stored in a dry place for the winter's work, and cut up as needed, and if any are not used, place the clumps outdoors for the summer in a shady place where they will grow on indefinitely until wanted for use.

The collection, manufacture, and export of osmundine is now quite a large industry, and the United States is supplying practically all the orchid-growing world with an admirable material, often in thousand-barrel lots, at a price below that of any other kind, with the additional advantage of being more durable than any other. The osmundas named are indigenous to all the eastern states, but the osmundine industry is confined at present to New York because of easy shipment. *Osmunda regalis* is not used, as it is more often found in swamps, and the root-fiber is likely to be sour. Moreover this species does not make the large clumps that the others do, making it unprofitable to gather them.

E. O. ORPET.

OSOBERRY: *Osmaronia*.

OSTEOMÈLES (Greek, stone apple or stone fruit). *Rosaceæ*, subfamily *Pomeæ*. Ornamental shrubs, sometimes grown for their graceful foliage and white flowers.

Evergreen: lvs. alternate, pinnate, with linear stipules; lfts. small, entire; fls. in terminal corymbs; calyx-teeth small, acute; petals 5, ovate-oblong; stamens 15-20; styles 5, distinct; ovary inferior, 5-celled, each

cell with 1 ovule; fr. a small pome with persistent calyx and 5 1-seeded stones.—Three species in E. Asia and Polynesia. Closely related to *Pyraeantha* and *Cotoneaster*, but easily distinguished by the pinnate lvs. The S. American genus *Hesperomeles*, with about 10 species, of which none seems to be in cult., is sometimes united with *Osteomeles*; it has simple lvs. and is apparently more nearly allied to *Cratægus*.

These plants are slender-branched shrubs with evergreen small pinnate foliage, and white flowers followed by bluish black berry-like fruits. All three species are in cultivation at least in Europe, but can be grown only in subtropical or warmer temperate regions, the hardest being probably *O. Schuerineræ*. They prefer a sunny position and well-drained soil. Propagation is by seed sown soon after maturity, but it germinates slowly, sometimes not until the second year, or by cuttings of half-ripened wood in July and August under glass; it also may be grafted on *cotoneaster*.

anthyllidifolia, Lindl. Shrub, to 6 ft., or more: young branchlets densely villous: lfts. 13-19, obovate-oblong or oblong, mucronate or obtuse, pubescent on both sides while young, later glabrous and lustrous above, silky pubescent beneath, $\frac{1}{2}$ - $\frac{1}{2}$ in. long; corymbs 1-1 $\frac{1}{2}$ in. across, grayish villous; fls. $\frac{1}{2}$ in. across; styles villous: fr. subglobose, bluish black, villous at first, finally nearly glabrous, about $\frac{1}{4}$ in. thick, sweet. Spring. Hawaiian Isls. to Pitcairn Isl. Trans. Linn. Soc. 13:8. —In the Hawaiian Isls. known as "uhi-uhi."

O. Schuerineræ, Schneid. Shrub, to 10 ft.; lfts. 17-23, oblong or narrow-oblong, acute, $\frac{1}{2}$ - $\frac{1}{2}$, rarely $\frac{1}{2}$ in. long, slightly pubescent or nearly glabrous; corymbs loose, slightly villous: fr. glabrous. S.W. China. B.M. 7354, G. 27:219, and G.C. III. 50:433 (as *O. anthyllidifolia*).—*O. subrotunda*, Koch. Low shrub: lfts. 11-17, obovate-oblong, obtuse; corymbs and calyx silky pubescent. S. Japan, S.E. China. H.B. 27:2644.

ALFRED REIDER.

OSTEOSPÉRMUM (Greek, bone seed). *Compósitæ*. A group of South African yellow-flowered shrubs or subshrubs, scarcely in cultivation.

Leaves alternate or rarely opposite: heads many-flid. radiate; pistillate fls. all rays; staminate fls. all disks, with abortive ovules and style; involucre in few rows, the scales free: achenes of the ray drupaceous or nut-like, thick, very hard, glabrous and without pappus.—Thirty-eight species are known, all S. African. In *Flora Capensis* 3:433-436, the whole group is monographed.

moniliferum, Linn. Shrubby, yellow-flid., grows 2-4 ft. high, and was offered in 1891 in southern Fla. It is a usually unarmed, much-branched, subshrub with leathery lvs. about 1 $\frac{1}{2}$ in. long. It is known in Austral. as the "bushtick berry." It appears to have dropped out of cult. There are many natural varieties, none of which seems to be known in cult. N. TAYLOR.

OSTRÔWSKIA (after N. ab Ostrowsky, Russian patron of science). *Campanulacææ*. GIANT BELL-FLOWER. One species, a very large-flowered perennial herb.

Very closely allied botanically to *Campanula* but distinguished, according to Hooker, by the whorled lvs., the numerous divisions of the calyx and



2683. *Ostrowskia magnifica*. (× $\frac{1}{10}$)



LXXX. *Osmunda cinnamomea*, the cinnamon fern, in its native place.

lobes of the corolla and of the cells of the ovary and stigmas, and by the pores in the caps, double the number of sepals.—The single species is a stately plant of Cent. Asia, first described as recently as 1884, and exhibited in England in 1888. It is a hardy plant, prop. readily by seeds if they are sown as soon as mature, although the plants may not bloom under 3 or 4 years. The long tuberous roots do not bear division well and this is probably one reason why it is not more popular with dealers.

The reason for *O. magnifica* not being catalogued in this country is the difficulty in its successful growing



2634. *Ostrya virginiana*.—Hop hornbeam. ($\times \frac{1}{4}$)

and over-wintering. It requires a light sandy soil, rich in humus and of considerable depth, for the roots of the thick fleshy stock go down deep. A high ground and open sunny exposure are a necessity. After the flowering season, plants like oriental poppies and *ostrowskia* dry up and should be kept dormant. To prevent growing in autumn, plantations should be protected from excessive moisture. A slopy ground with good drainage is of advantage. For winter cover, dry pine-needles covered with tar-paper are best; leaves will also answer, but by all means avoid manure protection. In early spring, the young growth needs to be protected from late frosts. Treated this way, *ostrowskias* can be grown in this country and are indeed beautiful border plants.—Propagation is by root- or top-cuttings in spring. Seeds unless sown fresh, require a long time for germination. Seedlings require from three to four years cultivating before reaching a really effective size. (Richard Rothe.)

magnifica, Regel. GIANT BELL-FLOWER. Fig. 2683. Tall strict glabrous herb, 4 or 5 ft. or more high, simple, with tuberous roots: lvs. in distant whorls of 4 or 5, ovate, toothed, short-stalked, 4-6 in. long: fls. 4 in. across at the mouth, pale lilac, but varying somewhat in tint; corolla broad-campanulate, the tube 2 in. long and ribbed, the lobes short and broader than long; calyx-lobes 2 in. long, spreading or recurved; floral parts 5-9, usually 7; style large, thick, yellow. E. Bokhara, at 7,000 ft. B.M. 7472. G.C. III. 4:65; 47:400, 401. Gn. 34:604; 52, p. 481; 64, p. 381; 73, p. 375; 75, p. 382; 77, p. 361; 78, p. 374. J.H. III. 60:493. Gt. 50, p. 431. G.W. 4, p. 387. Gn.W. 20:313. G. 30:351; 34:259. G.M. 31:459, 461; 51:765. R.H. 1893:472 and p. 473; 1888, p. 344. I.H. 35:71. S.H. 1:437. G.F. 6:276. A.F. 4:331. L. H. B.†

ÓSTRYA (ancient name). *Betulaceæ*. HOP HORN-BEAM. Trees grown for their handsome foliage.

Deciduous: winter-buds conspicuous, pointed: lvs. alternate, doubly serrate, plaited on the straight veins, with oblong or lanceolate stipules: fls. monœcious, in catkins; the staminate catkins slender, pendulous, with 3-14 stamens in the axil of each bract; filaments forked; pistillate upright, slender, with 2 fls. in the axil of each bract; the 2-ovuled ovary crowned by 2 slender stigmas and inclosed in a tubular involucre: fr. a nutlet inclosed by the bladder-like involucre; the inflated involucre loosely imbricated to form a strobile, resembling that of the hop.—Four closely related species in N. Amer., Eu., and E. Asia. From *Carpinus* distinguished by the bladder-like involucre.

The hop hornbeams are small or medium-sized trees with slender spreading branches forming a round or open head, with handsome bright green foliage, and rather inconspicuous flowers appearing with or before the leaves, followed by the attractive light green strobiles contrasting with the darker foliage. They are hardy and slow-growing, well adapted for planting in dry and exposed localities. The heavy and tough, very close-grained wood is used chiefly for fence-posts, handles of tools and other small articles. Propagation is by seed sown soon after maturity or stratified, otherwise it will usually not germinate until the second year; rarer kinds may be grafted on a common species or on the hornbeam.

virginiāna, Koch (*O. virginica*, Willd.). Fig. 2684. Tree, to 30, occasionally to 50 ft.: lvs. oblong-ovate, acuminate, glabrous above, pubescent on the veins below, with 11-15 pairs of veins, 3-5 in. long: strobiles slender-stalked, pendulous, $1\frac{1}{2}$ -2 $\frac{1}{2}$ in. long: nutlets spindle-shaped glabrous or nearly so. Dry woods. Cape Breton to Minn., south to Fla. and Texas. S.S. 9:445. Gn. 24, pp. 230, 231.—The lvs. change to clear yellow.

O. carpinifolia, Scop. (*O. vulgaris*, Willd. *O. italica*, Winkl. *O. virginiana* var. *carpinifolia*, Schneid.). Tree, to 30 or occasionally 50 ft.: lvs. short-acuminate, pubescent on both sides while young: nutlet ovoid, pubescent at the apex. Eu. R.H. 1905, pp. 188, 189. H.W. 2:18, p. 35. G.C. III. 8:274. Gn. 24, p. 231. G. 7:689.—*O. japonica*, Sarg. (*O. virginiana* var. *japonica*, Schneid.). Tree, to 60 ft.: lvs. pubescent beneath: strobiles shorter; nutlets glabrous at the apex. Japan. G.F. 6:384. S.I.F. 1:25.—*O. Knūblonii*, Coville. Tree, to 30 ft.: lvs. ovate or elliptic, obtuse or acute, 1-2 in. long; strobiles 1-1 $\frac{1}{2}$ in. long; nutlets minutely pubescent. Ariz. G.F. 7:115. S.S. 9:446.

ALFRED REHDER.

OSTRYÓPSIS (meaning *Ostrya*-like). *Betulaceæ*. A shrub most nearly related to *Ostrya*, but frs. tightly inclosed by the 3-parted involucre collected into slender-stalked heads or short racemes: anthers and filaments not divided. In habit and foliage it resembles *Corylus*. The only species is *O. Davidiāna*, Decne. Low shrub: winter-buds obtuse: lvs. ovate, doubly serrate and slightly lobed, pubescent beneath, $1\frac{1}{2}$ -2 in. long: involucre narrowed above the nutlet, $\frac{1}{2}$ in. long. N. and W. China, Mongolia. L.I. 3.—Has proved hardy at the Arnold Arboretum. Cult. and prop. like *ostrya* or *corylus*.

ALFRED REHDER.

OTAHEITE. Tahiti or Tahitian, for an island in the South Pacific, under French rule, as the Otaheite orange and Otaheite mulberry.

OTHÈRA JAPÓNICA: *Ilex integra*.

OTHÒNNA (ancient Greek name, of no particular application here). *Compósita*. Herbs and shrubs, of which one is in cultivation as a window-garden plant.

Heads usually yellow, with fertile rays and sterile tubular disk-florets; torus convex or somewhat conical, usually honeycombed; scales of involucre in one series, more or less united to the base, valvate; style of disk-fls. not divided: achenes oval, with bristle-like pappus in many rows or series.—About 80 S. African species, of which only one appears to be in general cult., and this has no established vernacular name in this country, although it is sometimes dubbed "little pickles" because of its cylindrical pulpy lvs.

The plant shown in Fig. 2685 is commonly known as *Othonna crassifolia*, but thereby arises a puzzle in nomenclature. By Linnaeus a certain flat-leaved plant was called *Othonna crassifolia*. Subsequently some of the species of *Othonna* were separated by Jaubert & Spach into a distinct genus, *Othonnopsis*, distinguished by involucre scales distinct and style of the disk-florets two-parted. One of the plants relegated to this new genus was *Othonna cheirifolia*, Linn., which then became *Othonnopsis cheirifolia*, Jaubert & Spach. Benthani & Hooker consider Linnaeus' *Othonna crassifolia* to be a horticultural form of *Othonnopsis cheirifolia*. It was

therefore a natural sequence to say that the *Othonna crassifolia* of horticulturists is properly *Othonnopsis cheirifolia*, a statement which the writer made in the revision of Gray's "Field, Forest and Garden Botany."



2685. *Othonna crassifolia*. A yellow-flowered trailing plant with succulent leaves.

It turns out, however, that the *Othonna crassifolia* of horticulturists is not the *Othonna crassifolia* of Linnæus (if he has been correctly reported). The former plant is a true *Othonna*. It is the *Othonna crassifolia* of Harvey; but since this name *crassifolia* was used by Linnæus, it leads to confusion to use it again in the same genus, and Harvey's plant might take some other name. In fact, before Harvey's time, the name *Othonna crassifolia* was used by Meyer for still another species. The *O. crassifolia* of Harvey was once described as *O. filiculis*, but this name also has been previously used in the genus. It seemed to the writer, therefore, as if a new name must be given to the *O. crassifolia* of Harvey and of the horticulturists, and this was done in the *Cyclopedia of American Horticulture* (*O. capensis*); but under the International Rules, Harvey's name may hold since the other *crassifolias* are clearly synonyms. What, now, is Linnæus' *Othonna crassifolia*? As early as 1771, this plant was figured in color by Philip Miller as the "*Othonna foliis lanceolatis integerrimis*" of Linnæus' "Hortus Cliffortianus." It was figured again by Edwards in 1818 (B.R. 266). It is an upright or ascending undershrub, with flat leaves reminding one of leaves of the stock. It is described in the European books, but is probably not in commercial cultivation. It is native to the north of Africa. A reproduction of part of Philip Miller's picture of the plant, reduced in size, is shown in Fig. 2686.

crassifolia, Harv., not Linn. nor Mey. (*Othonna capensis*, Bailey). Fig. 2685. Perennial, becoming shrubby at base in its native country, glabrous, with slender trailing or drooping sts.: lvs. 1 in. or less long, fleshy and cylindrical-obovoid, sharp-pointed, either scattered or in clusters; pedicels 2-6 in. long, ascending, slender; heads nearly or quite $\frac{1}{2}$ in. across when well grown, the narrow, bright yellow rays wide-spreading. S. Afr. V. 3:117; 10:138.—An excellent plant for hanging-baskets, for it withstands extremes of moisture and

temperature. It is readily prop. by planting pieces of the sts. It blooms in nearly all seasons. Fls. open only in sun. L. H. B.

OTTÈLIA (from a name in Malabar). *Hydrocharitaceæ*. Perhaps two dozen fresh-water herbs of the tropics and subtropics of both hemispheres, some of which may be useful as aquatics; lvs. both submerged and floating; the latter with long petioles, the blades lanceolate, ovate or cordate; scape elongated, bearing a fl. in a winged spathe; calyx 3-lobed; petals 3, yellow or white, much longer than calyx-lobes; stamens 6-10 or more, bearing erect anthers; fr. 6-valved, inclosed in the spathe. *O. alismoides*, Pers. (*Stratiotes alismoides*, Linn.) is of wide distribution. Afr. to Austral.: perennial, the lvs. arising from the base on long 3-angled petioles; blades broadly cordate, or rounded, obtuse, 2-6 in. or even more long or broad, 7-11-nerved; fls. white, the petals broadly ovate and 1 in. long. B.M. 1201 (as *Damasonium indicum*). G.W. 14, p. 658.—The plants are said to be eaten as pot-herbs by natives. L. H. B.

OURATEA (vernacular name in Guiana). Syn. *Gômphia*. *Ochnaceæ*. Tropical American shrubs and trees of minor importance horticulturally but sometimes grown for the yellow mostly paniculate fls. and evergreen foliage; glabrous; lvs. shining, stiff, alternate, serrate or toothed; sepals and petals 5; receptacle or torus prolonged into a gynophore; stamens 10, attached on base of torus, erect and connivent, the filaments very short; ovary deeply 5- or 6-parted; fr. 5 or less drupes, sessile on the enlarged torus or disk. *O. cuspidata*, Engler (*Gômphia cuspidata*, St. Hil.), from Brazil, is mentioned in horticultural literature abroad: shrub 3-6 ft.: lvs. alternate, elliptic, to 6 in. long, minutely toothed; fls. yellow, about $\frac{1}{2}$ in. across, in a terminal simple or branched panicle; petals obovate, more or less crisped. *O. olivæformis*, Engler (*O. decorans*, Baill. *Gômphia olivæformis*, St. Hil. *G. decorans*, Lem.). Tall shrub from Brazil: lvs. broad-lanceolate, shining, finely serrulate; fls. bright yellow, in a large dense terminal raceme; petals obovate and broad. B.M. 5262. G 27:325. Gn. 62, p. 339 (note). J.F. 4:415. L. H. B.

OURÍSIA (Governor Ouris, of the Falkland Islands). *Scrophulariaceæ*. Small herbs, used in alpine gardening and for borders.

Perennial, rarely somewhat woody at the base, usually dwarf, decumbent or creeping a short distance, glabrous or sparsely hairy; lvs. opposite, nearly all radical, crenate or entire; fls. either axillary and solitary, or in a raceme at the apex of a scape, usually scarlet or rose-colored; corolla-tube cylindrical or slightly bell-shaped at the throat, mostly somewhat curved, lobes nearly equal; stamens 4, didynamous; style entire; caps. 2-celled.—About 20 species in Tasmania, New Zeal., S. Amer.



2686. *Othonnopsis cheirifolia*, a flat-leaved plant which has been confused with *Othonna crassifolia*. (For comparison with Fig. 2685.)

coccinea, Pers. Hardy herbaceous perennial, sparsely hairy: lvs. mostly radical, long-stalked, heart-shaped, unequally lobed and crenate: scape furnished with 1- or 2-stalked lvs. at the base, and pairs of toothed bracts, from which the pedicels arise; calyx-lobes 5, short, spreading. Chile. B.M. 5335. G.M. 50:633.

macrophylla, Hook. (*O. robusta*, Col.). To 2 ft. high, from a short decumbent rhizome, mostly somewhat hairy: radical lvs. long-petioled, the blade 1-5 in. long and ovate to orbicular-oblong, crenate, thinish; st. lvs. only 1 or 2 pairs, sessile; fls. large (to $\frac{3}{4}$ in. diam.), white or with purplish streaks, in whorls or sometimes in a few-fl. umbel; corolla villous within, the lobes obovate and retuse. New Zeal. B.M. 8295. G.C. III. 45:390. J.H. III. 66:583. Gn. 73, p. 435. G. 34:641.—A good plant for blooming under glass in spring.

O. Cockayneana, Petrie. A New Zeal. species forming large matted patches, reported in England: sts. 3-6 in. or more long, creeping and rooting: lvs. ovate or ovate-spatulate, obtuse, crenate, with sheathing petioles: peduncles few-fl. and 3-6 in. high, bearing large white fls.

L. H. B.†

OUVIRÁNDRA (Madagascar name meaning *water yam*, referring to the edible tubers). *Aponogetonaceæ*. The lace-leaf or lattice-leaf plant, *O. fenestralis*, is one of the most distinct and interesting plants in cultivation. It grows in Madagascar, its skeletonized leaves floating just under the surface of the water. The genus is now included with *Aponogeton*, which see.

ÓXALIS (Greek, *sharp*, referring to the usual acidity of the foliage, which also gives the common name of sorrel). *Oxalidaceæ*, formerly treated as a division of *Geraniaceæ*. Mostly bulbous or tuberous herbs with clover-like leaves, usually cultivated as hanging-basket or window plants for their flowers; a few are used in salads and several South American species like *O. Deppei* (Gn. 8, p. 43) furnish edible roots or tubers.

Annual, or with a bulbous, tuberous or creeping, perennial rootstock: lvs. alternate, mostly digitately compound (3-foliolate in the native species); peduncles axillary, 1- to several-fl.; sepals and petals 5; stamens 10, monadelphous at base, 5 longer and 5 shorter; ovary 5-celled; several ovules in each cell; styles 5; caps. loculicidally dehiscent.—Over 400 species mostly of S. Afr. and the warmer parts of Amer. The fls. usually close at night and in cloudy weather, and the lvs. "sleep" at night (Fig. 2690). Trimorphic heterogone fls. occur in many species; our native *O. violacea*, sometimes grown as a hardy perennial, presents long- and short-styled fls.; and our common native yellow-fl. species offer puzzling transitions between heterogone and homogone types. The small seeds are interestingly discharged from the fr. by the pressure of a fleshy outer envelope. The classical works on the genus are Jacquuin's *Oxalis Monographia* (1794) and Zuccarini's *Monographie der Amerikanischen Oxalis-Arten*, and its Nachtrag (1825-31). Many of the earlier species, characterized by the relative length of stamens and styles, prove to be long-, short-, and mid-styled forms of identical species. The principal groups are sometimes segregated as distinct genera.

Generally speaking, the genus *Oxalis* is not highly esteemed by the florists. However, several species and varieties are used in masses for floral displays in botanical collections. The noteworthy species occasionally seen are *O. Bowiei*, *O. lasiandra* and its varieties *alba*, *carulescens* and *lilacina*, *O. variabilis* and its varieties *alba* and *rubra*, *O. Simsii*, and *O. rosea*. When used for display during February or March, the bulbs or tubers should be cleaned and divided into convenient sizes during August or September. Excellent results may be accomplished by potting three bulbs, forming a triangle in each 4-inch spot, placing them just below the surface of the soil. The soil ingredients should consist of loam, leaf-soil and sand, in proportion to give a good porous medium. As root-

action and growth increase, repot into 5- or 6-inch pots, which will carry them throughout the flowering period. Occasionally the crowns have a tendency to rise above the level of the soil; these may be lowered during repotting. When the plants are well rooted, periodical watering with organic fertilizer will help the development of good substantial flowers. During growth place the plants on the side stages near the glass in a temperature of 60° F. After the flowering period gradually reduce the water-supply and finally place in a cool cellar for the resting-period, or under the greenhouse bench, laying the pots side down. Specimen clumps are an acquisition planted below the benches in the floral display house; under these conditions they will practically naturalize themselves. Plants are also



2687. *Oxalis Ortgiesii*.

conveniently grown as common house plants, either in hanging-baskets or as pot-plants for the window during the summer months. When dormant they are easily stored in the cellar. A disappointing feature is the partial closing of the flowers during dull weather. (G. H. Pring.)

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A. Producing neither tubers nor bulbs.

B. Leafy-stemmed.

c. Lfts. notched at end.

n. Fls. red or rosy.

1. *rōsea*, Feuill. Tall, erect; petioles scarcely 1 in. long; fls. long-stalked, in open irregularly forked cymes on long axillary peduncles, rather large, rosy with deeper veins. Chile. B.M. 2830. B.R. 1123 (as *O. floribunda*).

2. *Simsii*, Sweet. Resembling the preceding but more delicate: fls. deep red. Chile. B.M. 2415.

nd. Fls. yellow.

E. Sts. erect.

3. *Ortgiënsii*, Regel. Fig. 2687. Red-tinged; st. tall, rather succulent; petioles long; lfts. deeply notched, with acute tips; fls. in close forked cymes on long axillary peduncles, small, yellow with deeper veins. Peru. Gt. 1875:817.



2688. *Oxalis corniculata*.

4. *valdiviënsis*, Barn. (*O. valdiviëna*, Hort.). St. short; lvs. clustered; petioles long; fls. in close umbels on long axillary peduncles, small, yellow with reddish veins. Chile.

EE. Sts. low or ereeping.

5. *corniculata*, Linn. (*O. stricta*, Linn.). Fig. 2688. Slender, prostrate, often rooting, loosely hairy; lfts. obcordate. Var. *atropurpurea*, Planch. (*O. tropæoloides*, Schlecht.). Spreading, red-purple; fls. few, in umbels on rather short axillary peduncles, small, yellow. Eu. F.S. 12:1205; 19:1968 (a form with variegated lvs.). R.H. 1897, p. 499.—A closely related smaller plant common everywhere as a greenhouse weed, especially in agave and cactus tubs, is the tropical *O. repens*, Thunb.

cc. Lfts. entire, separated.

6. *delicata*, Pohl. St. slender, erect, branching; lfts. ovate or lance-ovate; fls. in forked cymes on long axillary peduncles, small, pale rosy. Brazil.

7. *dispar*, N. E. Br. St. rather stout, tall, erect, branching; lfts. lanceolate, subacuminate, heavy-veined; fls. nearly sessile, in compact cymes on long axillary peduncles, rather small, golden. Guiana. B.M. 7794.

BB. Lvs. and scapes from sealy ends of the rootstocks.

8. *oregana*, Nutt. Low; lfts. broadly obcordate, 1-2 in. wide; fls. white or rosy, yellowish at base, deeper veined. N. W. coast.

9. *Acetosella*, Linn. Scarcely half as large in its various dimensions, otherwise very similar. E. U. S. and Eu. Fl. Dan. 980.—Often taken for the shamrock. Like the preceding, used sparingly in rockeries.

AAA. Producing tubers; not leafy-stemmed.

10. *rùbra*, St. Hil. Lvs. spreading, long-petioled, thin, somewhat hairy, obcordate; fls. in usually compound umbels, rosy with deeper veins. Brazil. Gn. 50, p. 511 (as *O. floribunda*).—Forms occur also with lilac or white fls.

11. *enneaphylla*, Cav. Fig. 2689. Lvs. crowded; lfts. 9-20, glaucous, $\frac{1}{2}$ in. long, obcordate-cuneate, nearly sessile; fls. large, solitary, white, with lavender veins. Falkland Isls. Gn. 52:202; 73, p. 339. G.C. III. 49:414. G.M. 50:565. G. 34:717; 36:719.—A rosy-fl. form is var. *rosea*, Hort.

12. *adenophylla*, Gillies. (*O. Bustillosii*, Phil.). Lvs. crowded; lfts. 12-22, glaucous, $\frac{1}{2}$ in. long, obcordate-

cuneate with short gland-like base; fls. large, solitary or in few-fl. umbels, rosy-tinged with deeper veins and base. Chile. B.M. 8054. G.C. III. 46:164; 55. 400. Gn. 75, p. 358. G. 35:237.

AAA. Producing bulbs.

n. Bulbs loosely scaly; not leafy-stemmed.

c. The bulbs compound, of numerous small ones; lfts. 3.

13. *Martiana*, Zucc. (*O. àrbica*, St. Hil. *O. bipunctata*, Graham. *O. floribunda*, Lehm. *Ionóxalis Martiana*, Small). Somewhat long-hairy; lvs. long-petioled, thin, obcordate, orange-warty beneath, at least around the margin; fls. in loose usually compound umbels, rosy. Trop. Amer. B.M. 2781, 3938.

cc. The bulbs simple.

14. *tetraphylla*, Cav. (*Ionóxalis tetraphylla*, Rose). Lfts. mostly 4, 1 in. long, inversely deltoid, retuse, each crossed by a purple band; fls. rather few in simple umbels, lilac or rosy. Mex. Cav. Icon. 237. G.M. 39, p. 403 (as *O. Deppei*). L.B.C. 8: 790.

15. *Déppei*, Lodd. (*Ionóxalis Déppei*, Small). Differs chiefly in the lfts. being truncate instead of notched at apex. Mex. L.B.C. 15:1500.

16. *lasiandra*, Zucc. (*Ionóxalis lasiandra*, Rose). Lfts. 5-10, several inches long, oblong, spatulate, entire at end, glabrous; fls. in crowded umbels, rosy crimson. Mex. B.M. 3896.—Under the variously used name "*floribunda*" said to occur in the color varieties *alba*, *cærulescens* and *lilacina*.

BB. Bulbs firm, usually fusiform; lfts. 3.

c. Fls. umbelled, large; acaulescent.

17. *Böwiei*, Herb. (*O. Bowiciana*, Hort. *O. purpurea*, Hort.). Fig. 2690. Lvs. spreading and large, fleshy, deep green; lfts. obovate, more or less notched; fls. bright rose-red. Cape. B.R. 1585. B. 1:25. R.H. 1858, p. 120. Gn. 10, p. 159; 37:508.

18. *cérnua*, Thunb. (*Bolbóxalis cérnua*, Small). BERMUDA BUTTERCUP. Fig. 2691. Lvs. ascending, not very large or fleshy, often purplish or mottled; lfts. obcordate; fls. bright yellow. Cape. L.B.C. 12:1154. B.M. 237.—A form with double fls. is var. *plena*, F.S. 19:1964.

cc. Fls. solitary on bractless or 2-bracted peduncles.

d. Lfts. broad, notched; nearly acaulescent.

19. *variabilis*, Jacq. (*O. grandiflora*, Jacq. *O. laxula*, Jacq. *O. purpurea laxula*, Hort. *O. rigidula*, Jacq. *O. suggillata*, Jacq. *O. variabilis albiflora*, Lindl.). Hairy; lvs. petioled, rather fleshy, often purplish; fls. large,



2689. *Oxalis enneaphylla*. ($\times \frac{1}{2}$)

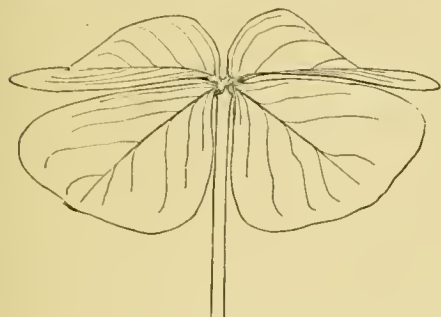
white or shaded with rose, yellow at base. Cape. B.M. 1683. B.R. 1505.—A form with deep rosy fls. is var. *rùbra*, Jacq. (*O. purpurea*, Jacq. *O. speciosa*, Jacq. *O. venusta*, Lowe). B.M. 1712. A white form, var. *alba*, Hort., is grown.

DD. Lfts. narrow or small; leafy-stemmed.

20. *versicolor*, Linn. (*O. elongata*, Jacq.). Glandular; lvs. petioled, clustered at top of the st.; lfts. linear-

wedge-shaped, notched; fls. white, margined with red, yellow below. Cape. B.M. 155. F.S. 8:834.

21. *hirta*, Linn. (*O. fulgida*, Lindl. *O. hirtella*, Jacq. *O. multiflora*, Jacq. *O. rosacea*, Jacq. *O. rubella*, Jacq.). Weak and spreading, hairy; lvs. nearly sessile, scattered; lfts. small, oblanceolate or spatulate, acute; fls. deep rose-color to lavender. Cape. B.R. 1073. B.M. 1031. L.B.C. 3:213.



2690. Leaves of *Oxalis Bowiei*, showing day and night positions.

O. japonica, Franch. & Sav. Lfts. broadly triangular, scarcely notched, and truncate. Otherwise similar to *O. Acetosella*. Japan. — *O. violacea*, Linn. Lvs. rather fleshy, glabrous; fls. in simple umbels, rose-violet. E. U. S. B.M. 2215. Mn. 5:121. — Scarcely useful, except for hardy borders or rockeries.

WILLIAM TRELEASE.

OXËRA (meaning dubious, probably referring to sourness). *Verbenaceæ*. Shrubby often climbing plants, useful for growing under glass for the showy flowers, but little known horticulturally.

Leaves opposite, entire, leathery; fls. whitish or yellowish, in twice- or thrice-forked cymes, varying greatly in form of calyx and corolla, but the latter always 4-lobed, and wide-throated; drupes 4-parted or by abortion reduced to a single segm.—Species about two dozen, New Caledonia.

pulchella, Labill. Lvs. 2–5 in. long, stalked, the lower ones oblong-lanceolate; calyx conspicuous, loose, composed of 4 more or less united greenish yellow sepals, each $\frac{1}{2}$ – $\frac{3}{4}$ in. long. B.M. 6938. Gn. 33:510; 45, p. 333. I.H. 36:76. J.H. III. 30:33; 42:39; 55:521. G.C. III. 3:209. R.H. 1890, p. 274.—Once offered by John Saul, Washington, D. C. Also cult. outdoors in S. Calif. It needs but a glance at any of the colored portraits of *O. pulchella* to see that it is one of the most interesting climbers cult. in hothouses. It has ivory-white trumpet-shaped sweet-scented fls. 2 in. long and 1 in. across, borne profusely in clusters of a dozen or more. A plant 2 years old from cuttings will clothe the rafters and bloom freely, the weight of the clusters causing the fls. to droop gracefully. The prominent calyx suggests *Clerodendron Thompsonæ*, a near relative. As the corolla-tube leaves the calyx, it makes a bend and then broadens into a funnel-shaped fl., with the 4 lobes scarcely spreading. The appearance of the fls. is enhanced by the long style and the 2 stamens, which are thrust out and strongly curved. It is reported as thriving in a winter temperature of 55–60°; it requires a warmer place than the ordinary greenhouse. It blooms well in the winter months. It prop. readily by cuttings placed around the side of a pot; also from seeds, which it matures in considerable numbers.

WILHELM MILLER.

L. H. B.†

OX-EYE: in America, *Heliopsis*; in Europe, *Bupthalmum*. **Ox-eye daisy**: *Chrysanthemum Leucanthemum* and *Rudbeckia hirta*.

OXLIP: *Primula elatior*.

OXYÁNTHUS (Greek, *sharp flower*; referring to the acute lobes of the corolla and calyx). *Rubiaceæ*. African trees and shrubs, allied to the cape jasmine

(*Gardenia*). They are remarkable for their extremely long and slender corolla-tubes, which are topped by a five-pointed star of spreading narrow lobes.

Leaves opposite; fls. usually white, in axillary racemes or panicles; calyx-tube truncate, or with 5 short teeth; corolla salver-shaped, throat glabrous; stamens 5, inserted at the mouth of the tube; ovary 2-celled, except in 1 species; style usually exserted; stigma usually spindle-shaped or club-shaped, 2-cut at the top; ovules numerous, not immersed in the 2 fleshy placenta: fr. a sort of berry.—Species 30–40, mostly in Trop. Afr., some in S. Afr.

natalensis, Sond. Branches, lvs. and calyx glabrous; lvs. elliptic-oblong or ovate-lanceolate, shortly acuminate, entire, 7–8 in. long, 3 in. wide; racemes axillary, loosely 16–20-fl.; fls. white, fragrant; corolla-tube about half the length of the lvs. Wet places in woods, Natal.—Cult. outdoors in S. Fla., and in Eu. under glass.

isthmia, Hort. Described as a splendid flowering shrub in S. Fla., similar to the above but with larger calyces and possibly more fragrance. Probably S. American, and requiring further study. The name is not identified botanically.

O. tubiflorus, DC. (*Gardenia tubiflora*, Andr.). Hispidulous-puberulous; lvs. obtusely rounded or somewhat eared at the base; fls. 6–7 in. long, at first creamy white, then tawny or ochrous; fr. terete, not grooved. Trop. Afr. F.S. 7:737. B.M. 1992 (as *O. speciosus*) 4636. J.F. 3:245.

WILHELM MILLER.

L. H. B.†

OXYDÉNDRUM (Greek, *sour tree*; from the acid taste of the foliage). Also written *Oxyéndron*. *Eri-cacææ*. **SOUR-WOOD** or **SORREL-TREE**. Ornamental tree



2691. *Oxalis cernua*.

grown for its white flowers appearing in summer and the handsome foliage turning scarlet in autumn.

Deciduous; lvs. alternate, petioled, serrulate; fls. whitish in terminal panicles composed of 6 or more

1-sided racemes; calyx divided nearly to the base into 5 sepals valvate in bud; corolla cylindric-ovoid, puberulous, with 5 minute lobes; stamens 10; anthers linear-oblong, opening from the apex to the middle; style slightly exserted; caps. ovoid-pyramidal, 5-valved, loculicidally dehiscent, many-seeded; seeds slender, the reticulate loose seed-coat produced at the ends into slender points.—One species in E. N. Amer.

A handsome medium-sized tree with slender spreading branches, rather large, generally oblong bright green leaves turning scarlet in fall and with small white flowers, followed by small grayish capsules nearly as conspicuous as the flowers. It is hardy North and of easy culture in any moderately good soil, but rather slow in becoming established and of rather slow growth. It is useful in shrubberies, along the borders of woods, or even within the woodland, since it endures shade fairly well. Propagation is by seeds treated like those of *Andromeda*.

arboreum, DC. (*Andrōmeda arborea*, Linn.). Fig. 2692. Tree with deeply fissured bark, occasionally to 60 ft. high; branchlets glabrous; lvs. slender-stalked, oblong-lanceolate, acuminate, broadly narrowed at the base, serrulate, glabrous except a few hairs on the midrib, 4-7 in. long; panicle 6-10 in. long; fls. $\frac{1}{2}$ in. long;



2692. *Oxydendrum arboreum*. Sour-wood or sorrel-tree. ($\times \frac{1}{2}$)

caps. $\frac{1}{3}$ - $\frac{1}{2}$ in. long. June-Aug.; fr. in Sept., Oct. Pa. to Ind. and along the mountains to Fla. and La. S.S. 5:235. B.M. 905. L.B.C. 13:1210. G. 27:415. F.E. 24:131. M.D.G. 1904:253. ALFRED REHDER.†

OXYLOBIUM (Greek, *sharp pod*). Including *Callistachys*. *Leguminosae*. One of many genera of Australian shrubs with pea-like flowers which are little known in cultivation.

Undershrubs or shrubs: lvs. very short-stalked, opposite or more or less whorled, rarely scattered or alternate; fls. in terminal or axillary racemes; petals clawed; stamens free; ovary villous, sessile or stalked, 4-30-ovuled. Nearest to *Chorizema*, but the keel is about as long as the wings, while in *Chorizema* the keel is much shorter. The following species was considered the type of another genus; it is distinguished from all other species of *Oxylobium* by the incomplete dehiscence of the pod.—Species nearly 30, of which perhaps a dozen have been cult. in Europe. Their fls. are yellow, or more or less flushed with red on the keel or the base of the standard. *O. Callistachys* is perhaps the best for conservatories. In America it is cult. only in S. Calif.

Callistachys, Benth. Tall shrub: lvs. mostly in irregular whorls of 3, varying from ovate-oblong and $1\frac{1}{2}$ -2 in. long to lanceolate and 4-5 in. long, leathery, silky-pubescent beneath when young; racemes oblong or pyramidal, 2-6 in. long. B.R. 216 (as *Callistachys lanceolata*). B.M. 1925 (as *C. ovata*). P.M. 8:31 (as *C. longifolia*). L.B.C. 20:1983 (as *C. retusa*). J.H. III. 35:35.

WILHELM MILLER.

OXYPÉTALUM (Greek, *sharp petal*). Incl. *Tweedia*. *Asclepiadaceae*. S. American and largely Brazilian herbs or subshrubs, twining or not; lvs. opposite; calyx 5-parted; corolla deeply 5-cut, short-tubed; scales of the corona 5, fastened at the base of the corolla and staminal tube.—Species about 100, not widely known in cult.

cæruleum, Decne. Herbaceous, but more or less woody below, downy; lvs. short-petioled, oblong, but cordate-hastate at the base; peduncles axillary from one of each pair of the upper lvs., 3-4-fld.; corolla lobes spreading; scales of the corona 5, erect, darker blue, fleshy, exserted, recurved and notched at the apex. B.M. 3630 (as *Tweedia versicolor*).—*O. cæruleum* is a tender twining plant from Argentina with changeable 5-lobed fls. about an inch across. The fls. are said to be pale blue when they first open, then purplish, and when withered lilac. Not cult. in Amer., but apparently desirable for cult. here.

solanoides, Hook. & Arn. (*Tweedia floribunda*, Hort.). Erect, little branched, shrubby or somewhat so, 6 ft.: lvs. lanceolate to oblong-cordate, acute, tomentose, the sinus at the base deep; fls. not so large as in *O. cæruleum*, bluish tinged rose (or dull purplish red), in terminal or axillary few-fld. cymes; staminal crown of 5 fleshy parts. Brazil. B.M. 4367. L. H. B.†

OXYPOLIS (derivation not explained). *Umbelliferae*. A few erect glabrous wet-ground perennials in N. Amer., seldom used in bog- and swamp-gardening; formerly known as *Tiedemannia*. The plants have tuberous clustered roots: lvs. pinnate or ternate, sometimes reduced to hollow and jointed phyllodia; fls. small, white, in compound mostly involucrate and involucrelate umbels; fr. glabrous, ovate or obovate, dorsally flattened, ribbed or winged. *O. rigidius*, Raf. (*Tiedemannia rigida*, Coult. & Rose), COWBANE, is a poisonous herb, 2-6 ft. tall, growing in swamps, N. Y. to Minn. and Fla., which was once offered in the trade: lvs. pinnate; lfts. oblong to ovate-lanceolate or nearly linear, entire or sparsely dentate. Probably not now listed.

OXYTENANTHÈRA: *Bamboo*.

OXYTROPIS (Greek, *sharp keel*). *Leguminosae*. Perennial herbs, half-shrubs and shrubs.

The genus is like *Astragalus*, but is distinguished by a subulate beak at the tip of the keel. The American species are tufted with numerous short sts. from a hard and thick rootstock: lvs. odd-pinnate with 7-16 pairs of lfts., which are woolly and white beneath; calyx tubular or tubular-campanulate; fls. pea-shaped (papilionaceous), with an erect standard, wings elongated, keel occasionally with thorn-like apex, longer or shorter than the wings, in racemes, spikes or heads and range from yellow, white through blue and purple to crimson: pods many-seeded.—About 234 species with the center of their distribution in Asia from Siberia to the Caucasus Mts. and Turkestan. A few species reach the mountains of Cent. Eu. None occurs in Afr. About 18 species found in the Rocky Mts. are referred to *Aragalus*, a generic name brought into prominence by E. L. Greene (*Pittonia* 3:208) and reviewed in *Erythra* 7:57-64 (1899) without definition. *O. Lambertii* is poisonous to stock. It is one of the most characteristic loco-weeds of the W. (see *Poisonous Plants*). Lococed

sheep are difficult to herd, as they stray away from the flock; slight locomotor ataxia is manifested with twitching of the eyelids and grinding motion of the jaws. About a dozen kinds of *Oxytropis* are cult. in Eu., mostly as rock plants. They are hardy, easily prop. by seeds or division, and prefer a dry, sandy loam. These plants are of minor value horticulturally.

A. *Stipules free; pod 1-celled.*

deflexa, DC. (*Arágallus deflexus*, Heller). Leafy-stemmed to nearly stemless, a foot or less tall with crowded lfts. in 12–16 pairs, lanceolate to oblong, 3–6 lines long; fls. rather small, about 3 lines long, pale purple; pods pendant, 1-celled, many times exceeding the calyx. Mountains, Brit. Amer. to Colo. and Utah. Fls. June, July.—Prefers moist open ground throughout the eastern Rockies at lower altitudes. A very distinct species by reason of its stipules almost free, or only slightly adnate to the base of the petioles.

AA. *Stipules decidedly adnate to petioles: pods not pendant, 2-celled.*

B. *Lvs. strictly pinnate; lfts. opposite.*

Lámbertii, Pursh. (*Arágallus Lámbertii*, Greene). Fig. 2693. A tufted perennial with strong taproot and several erect scapes, 4–20 in. tall: spike short-oblong, densely fld.; fls. usually purple or violet: lfts. about 7 pairs: pod broadly or narrowly oblong, silky pubescent, firm-coriaceous, 2-celled. Fls. June, July. Includes *O. campestris*, Hook. Fl. Bor. Am. in part, also *Arágallus patens*, *A. angustatus* and *A. atropurpureus* of Rydberg. B.M. 2147 (dark blue). B.R. 1054 (blue). V. 3:138.—Aven Nelson, in *Erythea* 7:62, says that the

specific name should be kept for the purple-violet-fld. forms. D. M. Andrews offers a crimson-fld. form and also var. **spicâta**, which has large spikes of white fls. Common along the Great Plains from Sask. to New Mex. and in the foothills where it is held to be responsible, as a loco-weed, for the poisoning and death of sheep and cattle. A clue as to its cultural requirements may be had from its wild habitat in open ground growing in masses of considerable extent.

BB. *Lfts. verticillate, numerous.*

spléndens, Douglas. A very showy, densely silky, silvery-villous, stemless, tufted plant, 4–18 in. tall: lfts. numerous, fascicled in 3's or 4's, as if verticillate: scape spicately, many-fld.; fls. bright-blue to deep purple, about $\frac{1}{2}$ in. long in June: pod ovate, hairy, much longer than the calyx. Native to open ground on the eastern slopes of the Rockies and in dry alpine meadows.

O. hybrida, Bruegg. Probably a hybrid between *O. campestris* and *O. sericea* or *O. Hallesi*. Perennial, from Switzerland.—*O. ochroleuca*, Bunge. Lvs. pinnate, 3–4 in. long, with oblong-lanceolate lfts.; fls. small, drooping, in short racemes, yellowish white. N. Asia.—*O. villosa*, Blank (*Arágallus villosus*, Rydb.). Densely caespitose: foliage silvery white; fls. creamy white, in dense spikes; calyx silky, villous; pod white-silky tipped with hooked beak. Mont.—*O. yunnanensis*, Franch. Sts. many, woody; lfts. in 8–11 pairs, lanceolate: fls. in dense head of 7–12, deep blue. Yunnan.

JOHN W. HARSHBERGER.

OXYÜRA: *Layia*.

OYSTER PLANT or SALSIFY: *Tragopogon porrifolius*.

OZOTHÁMNUS: *Helichrysum diosmæfolium* (*O. rosmarinifolius*).



2693. *Oxytropis Lambertii*. ($\times \frac{1}{2}$)

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